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UPSETTING THE BALANCE OF NATURE, WITH SPECIAL REFERENCE TO KANSAS AND THE GREAT PLAINS¹

By Dr. ROGER C. SMITH

PROFESSOR OF ENTOMOLOGY,² KANSAS STATE AGRICULTURAL COLLEGE

A HUNDRED years ago, the great plains were still largely in their primeval state. A balance of biological life or of organic groups had been set up through the ages and this balance probably then was but little disturbed. The land at that time was in permanent sod. This sod, in Kansas, was made up largely of some 40 species of grasses out of the known 372 species of the state. The plains probably were burned off every few years by fires, started by the Indians or by lightning. In the valleys and gullies, a few scrubby oaks and cottonwoods, honey locusts and elms had escaped the fires and were maintaining

a rather difficult existence. Herds of bison roamed the prairies, but they disturbed the vegetation little, since they did not stay long in any one place. Rattlesnakes, bullsnakes, coyotes, wolves, hawks and owls preyed largely upon the rabbits, ground birds, pocket gophers and prairie dogs. Great flocks of carrier pigeons roosted in the trees and, together with prairie-chickens, sage hens and bob-whites, fed upon berries, the seed of many weeds and grasses and many kinds of insects. Swarms of grasshoppers came occasionally, and no doubt at least partly defoliated the grasslands and the trees, but they were dealing with perennial plants then and these withstood the onslaughts of the hoppers.

About one hundred years ago the scene began to change, slowly at first but profoundly, nevertheless.

¹ Contribution No. 399 from the Department of Entomology, University of Kansas.

² Presidential address, delivered before the Kansas Academy of Science, McPherson, Kansas, on April 5, 1932.

Man, that great disturber of natural balances, came to this area, sometimes called the "Great American Desert," to establish homes and to wrest a living out of this virgin soil. He killed, often for pleasure, the bison, prairie chickens, sage hens, carrier pigeons and most of the snakes. He brought with him cattle to fatten and multiply on these fertile plains. He brought tools which tore up the aged sod, after which he planted some other grasses, such as corn, wheat, oats, rye, barley and sorghums. These plants were annuals, however, and far more delicate than nature's crop. This process which has continued to the present, has caused the great plains to lose more and more their old identity. Areas of virgin sod are not extensive now, except on the hill tops, which are good for little, agriculturally, but permanent pasture. Intensive grazing, even of these areas, has largely changed them from their primitive conditions. Prairie fires are no longer a factor, and Kansas to-day is one of the few states in the Union which has more trees than when it was settled.

Within the memory of the older residents, badgers were plentiful in Kansas. These animals are almost wholly insectivorous and helped to check the ancient pests of the still more ancient sod. Badgers are now very scarce in this state. The beaver likewise was fairly plentiful in the state, but they became a rarity before horseless vehicles appeared on the highways.

These profound changes have been accompanied by a recognizable series of biological phenomena which might be expected to follow, upsetting this ancient harmony among living things. It is my purpose to point out, not only some of the evidences, chiefly among our insect problems, of this unbalanced condition in nature, but also to offer some explanations for present wide fluctuations and to point out some of the forces working towards the establishment of a new balance.

The phrase, "balance of nature," is used to define that relative constancy of numbers of plants and animals over a long period of years, such that fluctuations in numbers ordinarily occur within relatively narrow limits only.³

One can not discuss animal populations without considering plant associations also, for the whole is a biological complex of the most intricate associations, as many writers have pointed out. The plant ecologists refer to this balance or complex among plants as "climax formation."⁴ I shall, however, discuss ani-

mals primarily and refer to plants only somewhat incidentally.

The annual population in nature of any short-lived plant or animal can be represented, not by a straight line, but by a narrowly undulating line about a straight line expressing a general average. Outbreaks are periods of excessive numbers which indicate that the species is out of balance. The food supply, weather and other natural checks must have been very favorable for excessive increase of the species. In the ideal balanced or stabilized natural environment, outbreaks would not occur, though there would be fluctuations in numbers due to changes in weather conditions from year to year.

The plowing up of the native sod and planting present-day crops were the first and most important steps in this balance upset. It gave the then existing native species of animals new food plants and, in many cases, supplied them with a habitat nearer their optimum than nature had provided.⁵ The natural result was an increased rate of reproduction with a consequent increased population of the species. Furthermore, it appears that the parasites of some of the more important insect pests require a period of years to adapt themselves to a new plant occupied by their host. This, no doubt, has been a factor in the relative unimportance of parasites in the effectual checking of most economic insects in the great plains region up to the present time. The wheat stem sawfly, for example, is said to be more heavily parasitized in wild and in other cultivated grasses than in wheat.

The change in the native flora of the prairie region is apparent to all. The fauna has been equally affected by agricultural development, insects and the smaller forms being somewhat less affected than the higher forms.⁶

Most plants and animals of the Great Plains exhibit more or less striking modifications for living there. Time does not permit a cataloging of the more striking adaptations, but many of them are common knowledge. One needs only to think of the adaptations of the grasses, tumbleweed, sunflower, cocklebur, ragweeds, of coyotes, jack-rabbits, pocket gophers, prairie-dogs, prairie-chickens and of the prairie snakes to their native habitat. The insects of the prairie have many structural adaptations which fit them for prairie life. Among these are the heavy integument of the wireworms and false wireworms, and the modifications for burrowing of many insects. These same modifications have made them all the more serious as pests of man's food plants.

³ Charles C. Adams, "An Outline of the Relations of Animals to Their Inland Environments," *Bull. Ill. Nat. Hist. Surv.*, 1915. 11 (No. 1): 1-32.

⁴ John E. Weaver and Frederic E. Clements, "Plant Ecology." McGraw-Hill Book Co., New York, 1929. (Ref. 458-469).

⁵ N. J. Atkinson, "The Increase of Native Insects to Economic Importance in the Prairie Provinces," *Scientific Agriculture*, 12: 200-203, 1931.

⁶ Wm. P. Hayes, "Prairie Insects," *Ecology*, 8: 238-250. Bibl., 1927.

THE GROWING OF WHEAT AND ITS EFFECT ON SOME GRASS-FEEDING INSECTS

The soil and climate of the Great Plains were early found to be well adapted to the growing of wheat. The 44-year mean annual rainfall of 27.1 inches for the whole state of Kansas is sufficient for the crop. This rainfall comes in the growing season, while the winters are usually dry with moderate temperatures. Splendid native soil fertility has made it possible in the great plains states to grow wheat in great quantity and of high quality. The large acreages and yields of the great plains states attest to the adaptation of this crop to the soil and climate of the region. It is sometimes called the "world's bread basket."

About the year 1775, an insect known as the Hessian fly (*Phytophaga destructor* Say) was accidentally introduced into the United States, presumably in straw brought over from Europe by Hessian soldiers. This creature found the opportunities in America to be all that had been said of them. The Hessian fly was a natural feeder on wheat, barley and rye in Europe, and on some of the wild grasses. Wheat, an annual grown in large acreages and a more succulent grass, is more to its liking than wild grasses. The climate of the great plains suited this creature perfectly. While in its native home it had to be content with one or two generations a year; in Kansas it could, with only rare exceptions, always have two or three generations and could in favorable seasons often produce four or five generations. Enemies were not very important factors. They could not keep up with such reproductive speed anyway, so we have in the Hessian fly an enemy of major importance to wheat. It may have changed its food plants to one of man's crops as the years have rolled around, but its environment has been changed to nearer its optimum. Nature's forces to maintain it within narrow limits of fluctuations have not yet proved effective.

As the years go on, natural enemies of the Hessian fly, aided by man, may be expected to increase in number, and probably in importance. Varieties of wheat resistant to this pest are now realities. Not to be outdone, however, the Hessian fly has appeared in strains peculiar to communities and to varieties, so it is prepared, as it were, to meet this new move.⁷ It is the old contest over again between the safe-maker and safe-breaker. Man's reliance on this crop for food forces him to engage in genuine combat with the Hessian fly and to assist mother nature to force this pest into a condition of relative obscurity, as it must have been when its food, in prehistoric times, was native grasses and wild rye in Europe.

⁷ Reginald H. Painter, *et al.*, "Resistance of Varieties of Winter Wheat to Hessian Fly," *Kans. Agri. Exp. Sta. Tech. Bul.* 27, 58 pp. 1931.

The false wireworms (*Eleodes* spp.) fed on weed seeds in the days of the old prairie. It was a short step to devouring the germinating wheat kernels in the dry soil when germination was delayed. To-day the false wireworms are major pests in the western half of Kansas and over much of the great plains region. Their adaptation to hard living conditions before man came here makes them most difficult to control.

The army cutworm (*Chorizagrotis auxiliaris*) is one of the best examples of a native grass-feeding insect which has lately become a serious enemy of many Kansas crops, including wheat, alfalfa, corn, oats and gardens. This insect is well equipped for life on the prairies. It feeds at night or during the afternoons of cloudy days. During the warmer part of the day it hides beneath the surface of the soil or trash, thereby reducing the danger from parasitism. When the brood has destroyed the vegetation in a field, it marches as an army, to an adjacent feeding ground. Observations have indicated that this species estivates in the adult stage (and probably in the larval stage also) during the hot summer, an adaptation to the high summer temperatures of the great plains area.

SOME NATIVE PRAIRIE INSECTS BECOME PESTS OF CULTIVATED CORN

Then the pioneers brought corn from Ohio and the New England states. This is another grass. It grew well in the valleys and served particularly for feed for domesticated animals. A little creature called the chinch-bug (*Blissus leucopterus* of the family *Lygaeidae*) now believed to be a native inhabitant of the great plains, found several of man's crops very much to its liking. It is significant that this insect returns to the bunch grass, its probably original or native food plant, to pass the winter. The chinch-bug spread with the growing of corn, oats, wheat and grain sorghum and forsook very largely the less succulent and tougher wild grasses. It is to-day a severe pest of these crops over most of the great plains region.

Whether a balance forcing this pest to relative obscurity, or at least to numbers comparable with other members of its family, will ever be attained is mere speculation. No other *Lygaeid* is so abundant or as destructive in the western hemisphere, and Imms mentions only one economic species from Egypt and one from Australia for the rest of the world.⁸ Again, varieties of corn and wheat resistant to this pest may check its conquest, but, so far, it shows little disposition to yield except when forced by an open warfare of man's artificial control methods.

⁸ A. D. Imms, "A General Text-book of Entomology," Methuen and Co., London. (Ref. p. 347).

The chinch-bug has few enemies. It is true that fungous diseases may develop and destroy them in great numbers, under favorable conditions, but it probably is no more serious to the chinch-bug race than an epidemic of influenza is to man. The chinch-bug egg parasite exerts a most inadequate check⁹ from man's view-point, though as many as 50 per cent. of the eggs may be destroyed by it.

Wireworms (*Melanotus* spp.) fed on roots of grasses before the great plains came under man's influence, but probably were of little consequence. The stand of these perennial grasses was thick and the root system large. They could easily spare a few roots. When the sod was plowed up and the land planted to wheat or corn, wireworms were provided with more attractive food. All the worms formerly in two or three square feet of sod concentrated on each hill of corn. The small stalks, in the spring, could not withstand their attacks. These native grass-feeding insects are to-day major pests in the eastern half of Kansas.

Other pests of corn have changed from wild food plants to this nurtured crop of man grown in large acreages. The common stalk borer (*Papaipema nebris*) may develop in as many as 176 different species of plants, most of them weeds. Even to-day weedy corn fields, or fields with weedy borders are more heavily infested with stalk borers than are clean fields. The corn earworm (*Heliothis obsoleta* Fab.), a native pest, probably maintained a precarious existence on teosinte, an ancestor of our corn, in Mexico, or in pods and fruits of some wild plants of the great plains region which, in Kansas, have been almost wholly forsaken now for the farm corn crop and alfalfa. Corn is most susceptible to attacks in the early spring when the plants are small and delicate.¹⁰ Its enemies are chiefly the grass-feeding forms which overwinter in some advanced stage of development.

Our grasshoppers are also native, so probably have been here for many centuries. They readily forsake the tough grass for the more succulent corn and alfalfa. It required no long adaptive processes on the part of grasshoppers, since they are general feeders and corn was immediately attractive. The great swarms of Rocky Mountain grasshoppers (*Melanoplus spretus*) of 1873-75, and earlier, are now mere interesting history. It is now known that this species is but a migratory or long-winged phase of one of our most common species, the lesser migratory grasshopper (*M. atlantis mexicanus*). There was an invasion

of the lesser migratory species in southwest Kansas in 1913, according to Professor George A. Dean, but it has not developed since, so far as Kansas is concerned. The grasshoppers which appeared last year (1931) were not migratory, but grew up and increased in numbers in the immediate community where they did their damage. Man is now armed with some good weapons in the warfare against grasshoppers, so farmers generally do not fear them but are able to cope with them. The frequent occurrence of outbreaks shows that they are still out of balance. When the great plains are more fully under cultivation, as occurs when the land is divided into small farms, grasshopper outbreaks will likely be a rare occurrence or be absent entirely. They continue in the great plains region as one of the few surviving biological remnants of the "wild and woolly West."

SOME NATIVE PRAIRIE FORMS WHICH ATTACK ALFALFA

From Persia to Europe, from Spain to Chile, to California, and then to Kansas came, some sixty years ago, a crop called alfalfa, lucern in Europe. It grew well, had few enemies and became a wonderful dual purpose crop. It built up the soil and furnished from three to five cuttings of good hay each year. Up to fifteen years ago it would maintain a stand on Kansas soils for ten to fifteen years. The large acreages and yields of the great plains states attest its success as an agricultural crop in this region.

The growing of alfalfa has become a difficult procedure during the last decade, and the acreage grown in Kansas has declined sharply. The average of 1930, 640,299, is a little less than half that of 1915, 1,359,498. Up to about 1905, the insect enemies were not very strong limiting agencies. Now, they so weaken the plants that disease, particularly root diseases, combined with other factors have reduced the life of the stand from ten or fifteen years to about three or four years. Several striking examples which suggest an explanation of this changing status may be mentioned.

The garden webworm (*Loxostege similalis*) had always been satisfied with weeds, chiefly pigweed (*Amaranthus*) and lamb's quarter (*Chenopodium*) but it has lately added alfalfa to its menu. In the 80's, when western Kansas was being settled, idle fields soon grew a crop of pigweed which was attacked by hordes of garden webworms. We have reason to believe that it now prefers alfalfa to weeds, since observations of the outbreaks in 1923 to 1931 have rarely shown a heavier attack on weeds than on alfalfa. If both were abundant, both were fed upon; if there were few webworms, they were largely confined to alfalfa. Its frequent outbreaks would indi-

⁹ J. W. McCulloch, "Further Data on the Life Economy of the Chinch-Bug Egg Parasite," *Jour. Econ. Ent.*, 1915, 8: 248-260.

¹⁰ Stephen A. Forbes, "The General Entomological Ecology of the Indian Corn Plant," *Bull. Ill. Nat. Hist. Surv.*, 16 (Art. 7), 447-457, 1929.

cate that the garden webworm is out of balance because alfalfa and other crops have unbalanced primitive nature.

The pea aphid (*Illinoia pisi* Kalt.) first appeared in outbreak proportions on alfalfa in Kansas in 1921 and became at once a major pest of the crop.¹¹ It had formerly existed in small numbers only on garden peas and the clovers. It was instrumental in the destruction of over 100,000 acres of alfalfa in this first outbreak and it has since continued as an annual threat to this valuable crop.

The fall army worm (*Laphygma frugiperda*) has likewise found alfalfa attractive. While not fully forsaking its native wild food of grasses, particularly bent grasses and volunteer wheat during late summer, it has become an almost annual pest of this crop, at least in localities.

The corn earworm first seriously damaged alfalfa foliage in Kansas fields in the fall of 1911. This insect has always shown a decided preference for corn, certain garden crops and cotton. The silks of corn are, however, too dry in September and October to be attractive to the moths, and the kernels are too hard for the larvae. The moths then feed on the nectar of alfalfa blossoms and lay their eggs on the tender green foliage of this plant. The parasitic enemies of the larvae can find them most easily when exposed on alfalfa plants, and the percentage of parasitism is always higher than in larvae taken from ears of corn.

Pocket gophers have increased in alfalfa fields because of the fine source of food offered by the roots and because snakes and hawks, their natural checks, have been killed off; so these and many more factors, without adequate checks, are making the growing of alfalfa difficult. From the view-point of nature, the insect pests and the gophers are merely operating to restore a balance in vegetation.

SOME MISCELLANEOUS EXAMPLES OF CHANGED FOOD HABITS OR HOST RELATIONS

The Colorado potato beetle (*Leptinotarsa 10-lineata*) was content to feed upon nightshade and horse-nettle (*Solanum* spp.) until cultivation of potatoes offered new fields of conquest. This insect has almost forsaken its wild hosts for this closely related but more succulent and more easily available crop.

The potato leaf-hopper (*Empoasca fabae*) probably was an unimportant feeder on some wild grasses in the historic past, but has since found such crops as beans, peas, alfalfa, red clover and potatoes much more to its liking. It has become a serious

enemy of all its hosts by causing an injury of the type known as "hopper burn" on potatoes. No group illustrates the change from a grass and weed-feeding status to an economic enemy of crops any better than do the leaf-hoppers.

Cattle appear to be more commonly attacked by enemies and diseases than was the native bison. The latter did not have to contend with tick fever, since this disease probably was introduced, supposedly by Spanish cattle. It appears that ox warbles may be native pests and not necessarily introduced from Europe, since they have been bred from buffalo¹². However, "The American bison do not appear to be so heavily infested as are cattle raised under similar conditions in the same region."

The vegetation of the great plains also shows a succession correlated with the progress of agriculture. Plowing up the sod makes possible the growth and multiplication of some weeds which were largely crowded out in competition with the dense sod. The common wild sunflower, the Kansas state flower, soon appropriates any idle fields. Russian thistle, according to my colleague, Dr. F. C. Gates, has attained its peak of population, and better agricultural practices are now reducing the numbers of this weed. Buckthorn (*Plantago lanceolata*) introduced as a contamination of grass or alfalfa seeds, appears to be on the increase. Dandelion and field bindweed both appear to be on the increase too. Even the eastern bluegrass has a foothold in the eastern third of Kansas and, though the climate is less suited to it than that of the North Central States, often crowds out native grass when the original sod is plowed up.

Many forms are even to-day in the process of changing from wild hosts to the cultivated crops of man. It may be that they find the cultivated crops more nourishing or more tasteful. Or perhaps it is because the cultivated plants are so much more accessible, since great areas of pure cultures occur. The sunflower beetle (*Rhodobaenus 13-punctata*) has lately been found to attack beets in Kansas. Flea beetles (*Epitrix* and *Systema* spp.) are increasingly important as pests of the early garden. So apparent is the shift from native prairie vegetation that at the Kansas State College and elsewhere especial study has been and is being made of this ecological unit or complex, since so many of our chief pests are native prairie forms which find the new order of things more favorable than the old prairie conditions.¹³

¹² F. C. Bishop, et al., "The Cattle Grubs or Ox Warbles. . . ." U. S. D. A. Dept. Bull. 1369. (Ref. on p. 20), 1926.

¹³ Charles C. Adams, "An Ecological Study of Prairie and Forest Invertebrates," Bull. Ill. Lab. of Nat. Hist., 11: 33-280, 43 plates, Bibl., 1915; Geo. O. Hendrickson, "Studies on the Insect Fauna of Iowa Prairies," Iowa

¹¹ Roger C. Smith and Edgar Davis, "The Pea Aphid (*Illinoia pisi* Kalt.) as an Alfalfa Pest in Kansas," Jour. Agr. Res., 33: 47-57, 1926.

There is evidence that one of the chief reasons why a balance is ultimately established in nature is that resistant plants survive, while the less resistant ones succumb. Therefore, in time, a certain amount of resistance to the attacks of parasite and animal enemies characterizes the native vegetation. Cultivated crops do not show this resistance unless resistant strains are selected by man to propagate the species or unless the crop has been grown in a fairly stable environment for a long time. There is further evidence that wild plants which exhibit certain degrees of resistance to enemy attacks in nature have this resistance factor weakened by a changed environment.¹⁴ Native prairie vegetation may be losing some of its vigor, hardiness and resistance to its enemies by the changed environment brought about by present-day conditions.

The principle of biological control is to increase the natural enemies or checks of a species by additional species of parasites, predators, or diseases, or by releasing, after artificial propagation, a large number of individuals of a common species. Some outstanding examples of biological control of noxious weeds and insects have occurred. The control of the cottony cushion scale by the Australian ladybird beetle is a well-known example among insect pests. The present-day control of prickly pear in Australia, with the cochineal scale insect and the control of the sugar cane moth borer in Hawaii, are well-known outstanding examples. In these and similar instances, man has aided nature in supplying the checks to certain forms which hold them to small numbers.

Eradication has never yet been attained in biological control and probably will not be accomplished. It is a graphic example, enacted dramatically in a brief space of time of a restored balance.

Man with his agriculture has upset the age-long balance of nature in the great plains region, and a new balance has not been reached. It probably is a long way off, in fact, since man is constantly changing his agriculture. Nature works slowly and not necessarily for the benefit of man. New factors under modern civilization are always being introduced which tend to postpone attainment of the new balance. Most natural checks, such as parasites, spread slowly. Man is aiding them somewhat. The native wild insectivorous birds are becoming more scarce. Their place is being taken by such forms as the English sparrow, mourning dove, grackles, crows, pigeons, robins and domestic fowls. These birds are primarily seed and fruit eaters, being only in part insectivorous, or insectivorous for part of the year. What is lost for man's welfare in one sector must be made up elsewhere by some other advances.

Insect and plant disease problems are actually increasing, both in number and severity in the great plains region. Man, the disturber, will have to employ artificial control efforts for a long time, or be seriously handicapped in his labors. This biological complex reminds us of a complicated and delicate machine in which a slight misadjustment of a part affects all the others. It is as a stone dropped into a quiet pool. The ripples travel outward on all sides and upset the grains of sand all along the shore.

VIRUSES¹

By Dr. T. M. RIVERS

ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

THIS is an age of extremes. Very tall buildings, exceedingly large ships and unusually fast automobiles are indicative of modern trends. Moderation no longer satisfies. This desire for the superlative has taken possession of workers interested in infectious maladies, and now it is a common occurrence to hear talk about the minutest incitants of disease, namely, those that penetrate the "very finest" and "most impervious" filters. Extremely high buildings are not necessarily beautiful and profitable. Nor is the fastest mode of travel always the safest and most enjoyable. Large incitants of disease may be just as injurious to their hosts as are extremely minute ones.

State College Jour. of Sci., 4: 49-179, 1930; J. E. Weaver, "The Environment of the Prairie," *Bull. No. 5, Bot. Survey of Nebr.*, 50 pp., 1931.

¹⁴ J. W. McColloch, "The Resistance of Plants to Insect injury," *Bien. Rept. Kans. State Hort. Soc.*, 37: 196-208, 1924.

¹ Presidential address, the American Society for Clinical Investigation, Atlantic City, May 2, 1932.

Yet the fact that a building is higher than all others and that certain etiological agents of disease are too small for resolution by means of a microscope lends an air of importance or mystery to the objects possessed of such unusual characteristics.

The sudden realization on the part of many workers that certain incitants of infectious disease may be very small and that types of infectious agents different from those already known may exist undoubtedly accounts for some of the present interest exhibited in viruses. These agents and the diseases caused by them are no more important now than they were formerly. Nevertheless, a concerted curiosity has served to focus attention upon them at this time. With this increased interest there have appeared in the literature many fantastic statements and unwarranted conclusions regarding the viruses. It is concerning some of these that I wish to make a few comments.

Before protozoa and bacteria were known to exist, infectious diseases were thought to be caused by the wrath of the gods, miasmas, dirt and configurations of the stars. The idea that maladies might be induced by minute plants and animals seemed absurd. After much work and strife, however, it was clearly demonstrated that bacteria and protozoa do incite disease. Indeed, the fact was so firmly established that most, if not all workers, reasoning by analogy, came to believe that all infectious maladies are caused by fungi, bacteria, spirochetes, protozoa, or some form of these agents. The notion now held by some workers that primitive forms of life different from those mentioned may exist or that inanimate agents, reproducible in series, may cause infectious diseases has seemed ridiculous to many investigators. Although such ideas appear strange at first, there is no obvious reason, except analogy, to suppose that infectious diseases can be caused only by fungi, bacteria, spirochetes and protozoa, or that all infectious agents must be animate. One should not be dismayed by new ideas lest in future years one be listed with the skeptics who continued to believe the world flat in spite of proof to the contrary. On the other hand, one should not be too eager to embrace every new doctrine lest the mental tranquillity secured by the acceptance of a logical explanation—not necessarily the true one—blunt intellectual acuity.

Frequently one encounters statements that the virus diseases represent a group of infectious maladies of unknown etiology or that the virus group serves as a "catch-all" for infectious processes whose inciting agents are unknown. Such statements indicate that the etiological agents of smallpox, vaccinia, yellow fever, rabies and poliomyelitis are unknown. It is true that the exact nature of these agents is unknown, but to say that the agents themselves are unknown is somewhat of an exaggeration. Individuals who believe them to be unknown tacitly admit that they are incapable of knowing infectious agents that are invisible or unable to grow on lifeless media. Without going into a detailed philosophical discussion of what can and can not be known, one is justified in saying that the viruses of smallpox, vaccinia, yellow fever, rabies, poliomyelitis, herpes simplex, foot-and-mouth disease, fowl-pox, fowl plague, canine distemper and psittacosis are not entirely unfamiliar to the initiate. They can be separated one from another and from ordinary bacteria. Furthermore, in many instances their presence in a variety of materials can be ascertained with much more ease and assurance than is the case with certain bacteria. The old admonition regarding human beings, "Ye shall know them by their fruits," is quite applicable to the

viruses, because they are known by their activities, that is, by the type of host or hosts attacked, by the clinical and pathological pictures induced, and by the immunological responses excited. In order to know an infectious agent it is not essential to see it or to grow it on laboratory media any more than it is imperative to see electricity in order to recognize it and to control it for our daily needs.

In 1873, Bollinger described in cells infected with the virus of fowl-pox large bodies that he considered the protozoan incitants of the disease. When it was demonstrated that the virus of fowl-pox is capable of passing through bacteria-tight filters, the Bollinger bodies, 7 to 25 μ in diameter, became discredited as the causal agent until Borrel and others showed that these structures consist of lipoidal capsules within which numerous minute coccoid bodies of uniform size are embedded in a protein matrix. At present certain investigators contend that the Borrel bodies are minute living organisms and represent the virus of fowl-pox. These contentions are based on the facts that the bodies are always present in infectious material, that they are uniform in size, that they have the appearance of minute organisms, and, finally, that they agglutinate in the presence of specific antisera. Such facts may be considered presumptive evidence that the Borrel bodies are minute organisms, but they are not conclusive, because as yet one can not by morphological and tinctorial data alone determine whether autonomous life exists in them. Furthermore, one dare not state that agglutination of particulate matter by a specific serum is proof of autonomous existence in such agglutinable particles, because it has been demonstrated that colloid particles treated with a variety of proteins and then thoroughly washed are specifically agglutinated by the proper antisera.

For a long time a few investigators have held that certain virus diseases are induced by ordinary bacteria. Now that attention is being focused on filterable forms of bacteria, workers in increasing number are adopting the belief that viruses are merely filterable, invisible and noncultivable elements of ordinary bacteria. Without going into details of the available knowledge of bacterial life cycles and their invisible and noncultivable forms, one can say that proof of many of the claims regarding them is lacking. Since even the existence of bacterial life cycles is doubtful, it seems unwarrantable to offer presumptive filterable forms of them as the explanation of another unsolved problem, the nature of the viruses.

Numerous workers seem to be convinced that the viruses are animate organisms, probably extremely minute bacteria. Yet they do not hesitate to state that the diameter of the etiological agent of foot-

and-mouth disease is 8 to 12 μ . If such figures are accurate, then this virus is indeed very small, not much larger than a molecule of hemoglobin which is now believed to be approximately 5.5 μ in diameter. Is it possible for an aggregate of so few protein molecules to be an organized living creature possessed of metabolic and reproductive powers comparable with those of minute bacteria? I am glad that I am not constrained to answer this question. Nevertheless, those who insist, without more evidence than is now at hand, upon the living nature or at all events upon the bacterial nature of the virus of foot-and-mouth disease, should at least manifest some appreciation of the difficulties of believing this.

As a rule viruses are smaller than ordinary bacteria. There is no reason to suppose, however, that all of them are of an identical order of magnitude any more than it is necessary to assume that all bacteria or all animals are of one size. Nor is there sufficient evidence to justify the belief that all viruses are of the same nature. Some may be inanimate transmissible incitants of disease, others may be primitive forms of life unfamiliar to us, still others may be minute living organisms. If it be assumed that the viruses differ in natures, one comes up against the question of why the diseases caused by them manifest many striking features in common. To find the answer to such a question may not be exceedingly difficult. At least a partial solution might well lie in the phenomenon of the intimate association of the viruses, animate or inanimate, with the susceptible host cells. Furthermore, the viruses may be situated near the line that separates inanimate transmissible incitants from minute living organisms. The transition from one side of the line to the other may be so gradual that no great difference in the types of disease caused by agents near the line is perceptible. Such a statement is strongly reminiscent of a remark by Aristotle that "nature makes so gradual a transition from the inanimate to the animate kingdom that the boundary lines which separate them are indistinct and doubtful."

To the naturalist it is undoubtedly of importance to know whether the viruses are living autonomous agents or products of cellular perversion capable of inciting similar perversions in other cells. Would a definite solution of this problem lead forthwith to great advances in the handling of virus diseases? At the moment I see no reason to suppose that it would. What, indeed, would be gained in this direction, were it possible to see, to define the nature of and to cultivate in abundance on ordinary media the etiological agents of poliomyelitis, smallpox, yellow fever, measles and varicella? Certainly nothing of a startling nature. Practical problems would for a

while at least remain much as they are now, because already the viruses of smallpox, vaccinia, poliomyelitis, yellow fever and many other diseases can be handled, identified and kept free from bacteria. Moreover, many of these maladies can be experimentally induced in animals and highly protective and neutralizing sera can be obtained. Furthermore, there are successful methods of vaccination against many virus infections, notably smallpox, rabies, yellow fever, fowl-pox, canine distemper and cattle plague. I have little patience with those who state that just as soon as the viruses are cultivated on lifeless media, it will be possible to make vaccines to prevent and sera to cure the diseases caused by them. Had we waited for the cultivation of the viruses, we would still be without Jennerian prophylaxis and antirabic vaccination. Indeed, Jennerian prophylaxis was firmly established before it was known that bacteria cause disease. Furthermore, it is exceedingly doubtful whether viruses cultivated on ordinary media would lead to the production of antiviral sera superior to the ones already obtainable, for example, those against smallpox, measles, yellow fever, foot-and-mouth disease and poliomyelitis, the value of which as curative measures is questioned by many investigators.

Numerous diseases spread by means of water, milk, food, filth and insect vectors have been controlled not by preventive vaccines and curative sera, but largely through the improvement of sanitary conditions. Many viruses obtain entrance into their hosts by way of the upper respiratory tract. Our inability to control disorders arising in this manner is not due to the fact that we have not used some special kind of medium for the cultivation of the viruses, but because it is essential that we breathe, and as yet no one has suggested a practical method of obtaining uninfected air for human beings living amongst their fellows.

For more than thirty years investigators in considerable number have waited for the veil of mystery that surrounds the viruses to be lifted by deft hands capable of cultivating these agents on lifeless media. If the viruses are minute obligate parasites incapable of multiplication in the absence of living susceptible host cells, or if they are products of cellular perversion reproducible in series, then to wait for this to eventuate is a waste of time. Fortunately a number of workers are already attempting by other means the study of the virus diseases and their etiological agents. That a certain amount of success may attend these methods is proven by the results of recent work on vaccinia, psittacosis, canine distemper, poliomyelitis and yellow fever.

OBITUARY

THOMAS H. GRONWALL

THROUGH the death, on May 9, of Dr. Thomas H. Gronwall, of Columbia University, America has lost one of its outstanding mathematicians.

Dr. Gronwall was born at Axberg, Sweden, on January 16, 1877. He received his Ph.D. from Upsala in 1898. He then went to Berlin, where, until 1902, he studied engineering. Soon after taking his engineering degree, he came to this country. Here he held various technical positions and also filled academic posts at Princeton and at Columbia.

Gronwall's work covered a wide variety of subjects. He wrote on analytic functions, infinite series, nomography, the analytic theory of numbers, differential geometry, integral equations, ballistics, elasticity, electrical theory and relativity. Some years ago he was associated with Professor V. K. La Mer in a revision of the Debye-Hueckel theory.

In pure mathematics, Gronwall's best known papers are probably those on analytic functions of several variables and on the summability of Laplace series. In his dissertation, he extended the Weierstrass factorization theorem to functions of several variables. In later work, he did much to clear up the problem of the representation of a meromorphic function of several variables as a quotient of two analytic functions. He developed for Laplace series a summability theory analogous to that of Fejer for Fourier series.

Gronwall's knowledge was encyclopedic. He was a prodigious reader, quick in assimilating ideas and retentive in memory. He possessed analytic skill of a high order and great elegance of style.

While Gronwall was of a reserved nature, those who knew him intimately appreciated the depth of his culture and his wealth of intellectual interests. In his premature death, we have lost a great savant and a brilliant personality.

J. F. RITT

COLUMBIA UNIVERSITY

ELLEN CHURCHILL SEMPLE—1863-1932

DEAN of American geographers, noted author, and one of the world's foremost educators, Miss Semple achieved a life marked by untiring devotion to duty. Louisville, Kentucky, was her birthplace in 1863, her parents being from two of the old families of the Blue Grass. In 1882, at nineteen, she became a bachelor of arts from Vassar College. Graduate work in history combined with extensive travels in Europe prepared her to take a master of arts degree at Vassar in 1891. Once more in Europe, she gave herself to work in anthropogeography under Ratzel, whose influence changed her interest from history to geog-

raphy. "American History and Its Geographic Conditions," published in 1913, was forerunner to a number of scholarly treatises including "Influences of Geographic Environment" and "The Geography of the Mediterranean Region."

Miss Semple was a truly great teacher. She set high standards, not only for us, but also for her successors. Although she was never trained specifically for the teaching profession, so outstanding were her accomplishments in the field of anthropogeography that she was called in succession to several European and American universities to lecture on geography.

Catholicity of interest and ability to select and apply facts and principles from an inexhaustible fund of knowledge lifted her lectures above the plane of ordinary instruction. She demonstrated to a marked degree how "nature and books belong to the eyes that see them." Her capacity for observation was enormous. Since her keen curiosity ever prompted her to seek and inquire, she derived the maximum benefit from her studies in the field. She knew "how wide was the far horizon of geography." Because of these qualities she vitalized her teaching by personal observations and incidents selected from her rich and varied experience. She told stories with true dramatic effect and with flashes of wit that enlivened her discussion and made it a real and dynamic exposition.

In 1914 she was awarded the gold medal of the American Geographic Society and in 1932 the gold medal of the Chicago Geographical Society. Upon establishing the Clark School of Geography, I called Miss Semple to be the first geographer of the new staff. Although she ceased university teaching two years ago, she continued on the faculty roll. As lecturer, writer and guide to students, Miss Semple had few her equal. She was a woman of exquisite personal charm and thorough scientific integrity. She exerted a compelling influence over all her friends and associates.

WALLACE W. ATWOOD

MEMORIAL TO DR. JOHN BRIQUET

DR. JOHN BRIQUET, late director of the Botanical Garden, Geneva, Switzerland, died on October 26, 1931, at the age of sixty-one years, after a brief illness. Those botanists who attended the International Botanical Congresses in 1900, 1905, 1910, 1926 and 1930 will realize the great loss botany has suffered by his death. As stated in a recent appeal issued by a committee of distinguished Swiss botanists, Dr. Briquet was an outstanding figure in all discussions on nomenclature, and the rôle he played as recorder, by his tactful, sagacious and conciliatory nature, together

with his great knowledge of languages and absolute command of the matter in hand, left an indelible impression on the minds of all. Thus he contributed greatly to the unifying of botanical nomenclature, and his services at the memorable congress held at Cambridge, England, in 1930 will long be gratefully remembered.

The Committee of Swiss botanists consisting of Messrs. Christ, Hochreutiner, Oechslin, Rübel, Schinz, Schröter and Wilezek, plan to provide a bronze bust of Dr. Briquet to be placed in the Conservatoire botanique in Geneva, along with those of Vaucher, De Candolle, Boissier, Ascherson, Engler and others who

very materially advanced the interests of the institution to which Dr. Briquet himself contributed in so large a degree. It is estimated that approximately \$1,000 will be needed for this most worthy memorial. The committee fully realizes the difficulty it faces in raising the necessary amount at this time, and expresses the hope that American botanists will generally subscribe to the project, in order that the task of establishing the memorial may be consummated without delay. Subscriptions may be sent to M. le Prof. Wilezek, Palais de Rumine, Musée botanique, Lausanne, Switzerland.

E. D. MERRILL

NEW YORK BOTANICAL GARDEN

SCIENTIFIC EVENTS

BIRTH RATES AND DEATH RATES

THE Metropolitan Life Insurance Company has made public the following facts in regard to the decline of the birth rate:

In twenty-four out of forty-two of the world's large cities the birth rate declined more than 5 per cent. in 1931 as compared with 1930.

The ten large German cities all showed declines of more than 10 per cent. in live births in 1931 over 1930. In Berlin the birth rate last year reached the low figure of 8.7 per 1,000, the lowest figure for any of the German cities having a population of 500,000 and over and one of the lowest birth rates for any city in the world. The 1931 birth rate in Berlin was the lowest in the history of that city and may be compared with the rates of 11.2, 17.5 and 11.4 per 1,000 prevailing in Berlin in 1925, 1920 and 1915, respectively. In Dresden and Frankfort the birth rate fell below 10 per 1,000 for the first time in the peace-time history of these two cities.

Every one of the fourteen large American cities recorded a drop in the birth rate during 1931. The decline was 22 per cent. in Boston and 17 per cent. in Detroit. The only large city in the United States with a birth rate over 20 per 1,000 was Pittsburgh, and there the rate declined more than 6 per cent. from the 1930 figure.

A favorable record was registered for mortality during 1931 in these world cities. All the German cities had either a substantially lower death rate in 1931 than in 1930 or else a stationary death rate. In Breslau and Frankfort the decline in mortality during 1931 was greater than 10 per cent. Munich, Leipzig and Dresden had declines of between 5 and 10 per cent. The Berlin death rate was unchanged.

Among fourteen of our American cities slight increases in the death rate were observed for five cities and decreases for six, with Detroit and Milwaukee

leading in the latter classification. How much of the decline in mortality, as well as in the number of births, in Detroit was due to the emigration of persons by reason of the prevailing unemployment conditions is not known. The death rate in New York City showed a very small increase, less than 1 per cent. during 1931.

World economic conditions during 1931 affected chiefly the birth rate, and this may be a side effect of prevailing world conditions upon the marriage rate. The extent to which declining marriages in 1930 and 1931 affected first births, the crude birth rates and infant mortality rates in 1931 can not as yet be determined from the figures at hand. Death rates and infant mortality rates have not shown as yet any definite effect of the economic situation.

INVESTIGATION OF THE WOODS OF THE WORLD

A SYSTEMATIC investigation of the woods of the entire world by the International Association of Wood Anatomists is now well advanced, according to a statement made public by the secretary-treasurer, Professor Samuel J. Record, of the Yale School of Forestry, who recently announced the results of a conference, held in New Haven, of representatives of the Bussey Institution and the biological laboratories of Harvard University, the botanical department of Cornell University, and the forestry department of Yale. The organization has a membership of fifty investigators in eighteen different countries under the direction of an executive council of eleven members of eight nationalities.

The largest and most comprehensive collection of woods in existence at present is at the Yale School of Forestry. It contains over 21,000 fully catalogued samples representing over 6,000 named species of about 2,000 different genera. Cuttings large enough

for scientific studies have been made of selected groups and forwarded to workers in several institutions in the United States, Canada, England, Holland, Germany, France, Russia, Japan, Australia and New Zealand. Another large collection is at Buitenzorg, Java, with 15,000 samples of Dutch East Indian woods. There are also large collections in the Philippines, India, Federated Malay States, as well as in European countries, and hundreds of samples have already been distributed for special research.

The Yale Forestry School is trying the experiment of providing small subventions for local collectors in tropical countries and is said to be meeting with marked success. Over 300 timber samples have recently been received as the result of a local expedition into the high mountain range near Santa Marta, Colombia. The Lower Amazon region is being explored by Dr. Alphonso Ducke, of the Botanical Garden of Rio de Janeiro. Dr. A. Rimbach is collecting in the interior of Ecuador, a locality almost unknown to the outside world. A good collection of woods has been made for the first time on Mt. Kinabalu in British North Borneo. The most recent expedition is that of Mr. J. H. L. Waterhouse, of Australia, who is collecting on the British Solomon Islands Protectorate. This undertaking is in cooperation with the Royal Botanic Gardens, Kew, England, and has the sanction of the high commissioner for the Western Pacific and the resident commissioner at Tulagi. There are, in addition, many local collectors in out-of-the-way places in the tropics.

The first step toward uniformity of botanical terms has been the making of a dictionary, now undergoing its second revision, which is in English, French, German, Dutch, Spanish, Portuguese and Polish. This will be made the basis for a book in which every term will be fully illustrated and described.

GOVERNMENT CONTROLLED FOREST LANDS

THE merging in one department of all federal agencies and auxiliary services administering government owned or controlled forest lands has been recommended by an advisory subcommittee of the U. S. Timber Conservation Board headed by Dr. Henry S. Graves, dean of the School of Forestry of Yale University. According to a statement issued by the board, the principal recommendations are:

Merging in one undesignated department the several administrations of federally-owned or controlled forest lands, together with all auxiliary services pertaining thereto.

The abolishment of the present system of paying to counties a percentage of the National Forest receipts, substituting therefor direct contribution to be ad-

justed, in a degree, to local needs. This is to be paid annually and such procedures should possibly be helpful in improving state forest taxation methods.

Extreme conservatism in public timber disposal, apparently recognizing the principle that publicly owned timber is a reserve supply to be drawn on only as required to advance public interest, local and national.

Steps to harmonize federal forest acquisition and administration and to promote sound controls thereunder.

Cooperative study by government and states of problems of tax delinquency in critical regions where forestry protection is threatened. This may suggest either public acquisition or the use of public timber supply to extend the operations of private concerns toward the continuance of local community interests.

THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

THE annual meeting of the American Society of Agricultural Engineers was held at Ohio State University from June 20 to 23. A symposium on "An Engineer's Policy for Agriculture" was a feature of the meeting. The president of the society, Leonard J. Fletcher, of Peoria, Illinois, general supervisor of agricultural sales of the Caterpillar Tractor Company, presided. The speakers were C. F. Kettering, of Detroit, president of the General Motors Research Corporation; J. T. Jardine, chief of the Office of Experiment Stations, U. S. Department of Agriculture, and Arthur Huntington, public relations engineer of the Iowa Railway and Light Corporation. Several hundred engineers, economists, farm leaders and scientific men from universities, technical schools, the industries and state and federal services participated.

The convention opened with sessions of the college division. Among the speakers were R. J. Baldwin and George Amundson of Michigan State College; Ben D. Moses, of the California Agricultural Experiment Station, and R. W. Trullinger, of the U. S. Department of Agriculture. The topics discussed included cooperative relations with industries, agricultural engineering teaching, agricultural engineering research, agricultural engineering extension, relations with vocational education, and logical future development of research in agricultural engineering.

Dr. George W. Rightmire, president of the university, addressed the delegates on Tuesday morning and Mr. Fletcher delivered the annual presidential address. Other addresses included "Adventures in Science" by Dr. L. A. Hawkins, of the Research Laboratories of the General Electric Company; "Fuels for High-Compression Motors," by Thomas Midgley, Jr., a director of the American Chemical Society; "An Agricultural

Engineer's Observations in Russia," by E. J. Stirnman, formerly associate professor of agricultural engineering at the University of California and later agricultural engineer for the Grain Trust of the Soviets, and "To-morrow's Job for the Agricultural Engineer," by President Fletcher.

At a general session on Thursday morning L. A. Jones, chief of the division of drainage and erosion control, Bureau of Agricultural Engineering, U. S. Department of Agriculture, discussed "Soil Erosion—A National Menace"; M. S. Winder, secretary of the American Farm Bureau Federation, spoke on "How the Farmer Looks at the Engineer," and Professor F. W. Duffee, of the University of Wisconsin, described "A Specific Example of a Planned Engineered Agriculture."

Other speakers at the Columbus meeting were: Professor Moses; W. B. Robert, Aluminum Company of America; M. A. R. Kelley and S. P. Lyle, U. S. Department of Agriculture; H. B. White, University of Minnesota; J. L. Strahan, consulting agricultural engineer; Professor F. L. Fairbanks and Professor H. W. Riley, Cornell University; F. P. Hanson, Caterpillar Tractor Company; Professor L. D. Baver, University of Missouri; Roy Bainer and J. P. Fairbank, University of California.

THE INTERNATIONAL CANCER RESEARCH FOUNDATION

MR. WILLIAM H. DONNER, of Villanova, Pa., retired steel manufacturer of Pittsburgh, has placed at the disposal of this foundation cash and securities on the basis of to-day's values amounting to \$2,000,000. This was set aside by Mr. Donner as a trust in 1929 when his son, Joseph W. Donner, died in Buffalo.

The object of the foundation, as announced by Mr. Donner, is to "increase interest in and the amount and quality of cancer research; develop new minds and theories; broaden the viewpoint of some investigators already in the field, and increase cooperation among scientists throughout the world, correlating results of their investigations and preventing duplication of work."

No money will be given for buildings, and the funds will not be spent in any one institution, state or country. Not more than 35 per cent. of its income is to be allotted to one institution, not less than 50 and not more than 65 per cent. within the United States.

At the organization meeting on June 8, the following officers were elected:

President: W. H. Donner.

Vice-President: A. V. Morton.

Treasurer: The Fidelity-Philadelphia Trust Company.

Secretary: Dr. M. W. S. Schramm.

The directors include, in addition to the president and vice-president: Dr. Thomas S. Gates, president of the University of Pennsylvania; The Honorable George Wharton Pepper, former United States Senator; Dr. Edward R. Weidlein, director of the Mellon Institute of Industrial Research, of Pittsburgh.

Drs. James Ewing, of New York City; Burton T. Simpson, of Buffalo, and Francis Carter Wood, of New York City, constitute the scientific advisory committee.

RETIRING MEMBERS OF THE FACULTY OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

THE retirement of four members of the faculty of the Massachusetts Institute of Technology after more than forty years of service, has been announced. These are Frank A. Laws, professor of electrical measurements; James R. Lambirth, assistant professor of mechanical engineering; Robert H. Smith, professor of machine construction, and Arthur G. Robbins, professor of topographical engineering. They all retire with the title of professor emeritus.

Professor Lambirth has had the longest service. He has been instructing in forging for 48 years, and nearly 15,000 students have passed through his class. At the age of eighty-four years he is still active. He is a native of Chelmsford, England. Professor Lambirth joined the staff of the institute in 1884. Until several years ago he had not known illness, and for thirty-nine years he never missed a class.

Professor Laws, who is a native of Brockton, is a graduate of the class of 1889. He joined the staff in the year of his graduation as an assistant in physics, and in 1897 became assistant professor of electrical measurements. From 1906 until 1913 he held an associate professorship in electrical testing. Professor Laws was a member of the staff of the research laboratory of electrical engineering in 1913-14, and a member of the research division of the department since 1918.

Professor Smith's teaching career at the institute began in 1886. In 1919 he was appointed assistant professor of mechanical engineering, and was promoted to the rank of professor of machine construction in 1931. Professor Smith is well known to generations of Technology students. He is the author of "Elements of Machine Work," "Principles of Machine Work," and "Advanced Machine Work." In April, 1928, he was elected an honorary member of the Technology Alumni Association.

Professor Robbins in 1886, the year of his graduation, joined the staff as assistant in civil engineering. He was appointed assistant professor of high-

way engineering in 1896, and in 1906 became associate professor of topographical engineering. He was promoted to the grade of professor three years later. For many years he was a member of the teaching staff at Technology's summer school of civil engineering at East Machias, Maine. He is a member of the Boston

Society of Civil Engineers and affiliated with the American Society of Civil Engineers.

To each of these retiring members President Compton has written an expression of the gratitude of the institute for their long and important service to the institute.

SCIENTIFIC NOTES AND NEWS

DR. GRAHAM LUSK, professor of physiology emeritus at the Cornell University Medical College, has been elected a foreign member of the Royal Society, London.

AT a dinner of the Advisory Board of the Wistar Institute of Anatomy on May 29 Dr. George E. Coghill, managing editor of *The Journal of Comparative Neurology*, announced the dedication of a complimentary volume of the journal to Dr. Henry H. Donaldson in celebration of his seventy-fifth birthday and in recognition of his many years of service to the science of neurology.

THERE will be held a meeting of appreciation and a tribute to Frank J. Sprague, the distinguished electrical engineer, on July 25, the seventy-fifth anniversary of his birth. The meeting will be held in the Engineering Societies auditorium at 8 o'clock, and addresses will be made as follows: "An Engineer's Contribution to the World's Welfare," Dr. John H. Finley; "An Engineer's Contribution to Transportation," Mr. Frank Hedley; "Frank J. Sprague—A Tribute," Rear Admiral S. S. Robison, U. S. N. (ret.); "Response" by Mr. Sprague.

YALE UNIVERSITY has conferred the doctorate of science on Dr. Frank R. Lillie, professor of embryology in the University of Chicago, and the doctorate of letters on Lieutenant Colonel Fielding H. Garrison, librarian of the Institute of the History of Medicine at the Johns Hopkins University.

DR. HARVEY CUSHING, who retired this year from the Moseley professorship of surgery at the Harvard Medical School, received at commencement the degree of doctor of science from Northwestern University.

AMONG the honorary degrees conferred at commencement by Boston University was the degree of doctor of science on Dr. Frank B. Mallory, professor of pathology at the Harvard Medical School, and on Dr. William P. Graves, surgeon-in-chief at the Free Hospital for Women, Brookline.

HONORARY degrees were conferred on June 13 by the Ohio State University on Charles F. Marvin, chief of the United States Weather Bureau, and on Walter C. O'Kane, professor of economic entomology at the University of New Hampshire.

THE doctorate of science was conferred at the recent commencement of Colgate University on Dr. Strashimir Alburtus Petroff, director of the Trudeau Sanitarium laboratory, Saranac Lake, New York; on Dr. Homer Levi Dodge, professor of physics and director of the graduate school at the University of Oklahoma, and on Dr. Ross Vernet Patterson, dean of Jefferson Medical College, Philadelphia.

AT the commencement exercises of Washington and Jefferson College on June 4, the honorary degree of doctor of science was conferred on Dr. D. J. McAdam, Jr., metallurgist of the U. S. Bureau of Standards.

AT the recent meeting of the Royal Society of Canada, the Sir Joseph Flavelle medal for science was presented to Dr. J. S. Plaskett, director of the Dominion Astrophysical Observatory at Victoria, British Columbia.

A PORTRAIT of Lord Rutherford, painted by Mr. Oswald Birley, was presented to the Royal Society on June 9.

A PORTRAIT of Dr. George F. Kay, dean of the College of Liberal Arts of the University of Iowa, was unveiled at the commencement dinner on June 2, and presented to the university as a gift of the graduating classes. The portrait was painted by the late Professor Charles A. Cumming, who for many years was head of the department of graphic and plastic arts in the university.

A PORTRAIT of Dr. J. McKeen Cattell has been presented to him by colleagues and former students. The painting is by Leopold Seyffert, N.A. The committee in charge consisted of Professor A. T. Poffenberger, of Columbia University; Professor S. I. Franz, of the University of California at Los Angeles, and Dr. F. P. Keppel, of the Carnegie Corporation.

PROFESSOR GEORGE H. SHULL, of Princeton University, has been elected a corresponding member of the German Botanical Society on the occasion of the fiftieth anniversary of its founding. Americans already on the list are R. A. Harper, A. S. Hitchcock, E. D. Merrill, B. L. Robinson and William Trelease.

DR. WILLARD BERRY, of the department of geology of the Ohio State University, has been elected a corresponding fellow of the Geological Society of Peru.

THE Academy of Natural Sciences of Philadelphia has elected as correspondents the following: Liberty H. Bailey, Henry B. Bigelow, Reginald A. Daly, Ludwig Diels, John Stanley Gardiner, Hugo Glück, William D. Gregory, A. S. Hitchcock, Adolfo Lutz, Emmanuel de Margerie, Elmer D. Merrill, Edward W. Nelson, Albert C. Seward, Edgar O. Ulrich and B. P. Uvarov.

IN recognition of her flight across the Atlantic, the special gold medal of the National Geographic Society was presented to Mrs. Amelia Earhart Putnam by President Hoover in special exercises on June 21. After the presentation Mrs. Putnam related to members of the society the story of her flight.

A DINNER was given to Dr. Walter R. Parker by his friends and colleagues on May 24, on the occasion of his retirement on July 1 as professor of ophthalmology in the University of Michigan Medical School. Dr. Frederick G. Novy presided as toastmaster at the dinner, and Dr. Alexander G. Ruthven, president of the university, made the opening remarks.

DR. ESMOND R. LONG, who recently resigned as professor of pathology in the Graduate School of Medicine of the University of Chicago, to go to the Phipps Institute of the University of Pennsylvania as director of laboratories, was awarded the Trudeau Medal by the National Tuberculosis Association at its annual meeting in Colorado Springs, Colorado, on June 6. The medal is awarded each year "for outstanding service to the tuberculosis movement."

DR. HENRY JAMES SPENCER has been appointed director of the second medical (Cornell) division of Bellevue Hospital, to succeed Dr. Eugene F. DuBois. Dr. Spencer has also been appointed assistant professor of clinical medicine in the Cornell University Medical College.

DR. L. P. SMITH, who has been spending the past year in Munich and Utrecht as National Research Fellow, has been appointed assistant professor of physics at Cornell University.

DR. K. H. GOODE, assistant professor of chemistry at Colgate University, has resigned. Dr. Sidney J. French, department head of chemistry at Franklin College, has been appointed assistant professor of chemistry, and Dr. D. W. Trainer, Jr., has been promoted from instructor to assistant professor.

AT the Long Island College of Medicine, Brooklyn, N. Y., Dr. Alfred C. Beck has been appointed professor of obstetrics and gynecology, to succeed the late Dr. John O. Polak. Dr. Edgar D. Congdon has been appointed professor of anatomy. For the past five years he has been in charge of the department of anatomy at the Medical School of Chulalankarana

University, Bangkok, Siam. There has been created within the department of medicine a division of preventive medicine and community health. This has been placed in the hands of Dr. Alfred E. Shipley.

WE learn from *Nature* that at the annual general meeting of the Institute of Physics held on May 24, the following were elected to take office on October 1 next: *President*, Lord Rutherford; *Honorary Treasurer*, Major C. E. S. Phillips; *Honorary Secretary*, Professor A. O. Rankine. The other vacancies on the board were filled by the election of Professor H. S. Allen and Dr. C. V. Drysdale as vice-presidents, and Mr. R. A. Watson Watt and Mr. D. Orson Wood as non-official members. Sir Frank Dyson and Sir William Bragg were elected honorary fellows of the institute.

ALFRED P. SLOAN, JR., president of the General Motors Corporation, and Dr. Harlow Shapley, director of the Astronomical Observatory at Harvard University, have been elected life members of the corporation of Massachusetts Institute of Technology. Martin H. Eisenhart, vice-president and general manager of the Bausch and Lomb Optical Company, Rochester, New York; Bradley Dewey, president of the Dewey and Almy Chemical Company, Cambridge, and Jerome C. Hunsaker, vice-president of the Goodyear-Zeppelin Corporation, have been elected by the alumni association term members of the corporation to serve for five years.

THERE were elected at the annual meeting on April 23 of the Division of Geology and Geography of the National Research Council, officers, members and executive committee for the year 1932-1933, as follows: *Chairman*, W. H. Twenhofel; *Vice-chairman*, O. E. Baker; E. C. Case, representative of the Geological Society of America; August F. Foerste, representative of the Paleontological Society; Nevin M. Fenneman, representative of the Association of American Geographers; Mark Jefferson and Morris M. Leighton, members at large; *Executive Committee*, W. H. Twenhofel, O. E. Baker, Edson S. Bastin, W. L. G. Joerg, Sidney Powers and Clarence S. Ross.

A GRANT has been made by the Committee on Scientific Research of the American Medical Association to the department of anatomy of the Vanderbilt Medical School for research on the effects of certain colloidal solutions on experimental syphilis.

PROFESSOR PICARD, accompanied by Professor Max Cosyns, of the Queen Elizabeth Scientific Foundation, will make his second ascent for the scientific exploration of the stratosphere about the end of June or the beginning of July. The ascent, which will be made from Zurich, will have for its principal object the study of the cosmic radiation. The balloon with which

the first ascent was made will be used, but a new nacelle will be constructed.

PROFESSOR CARL L. A. SCHMIDT, chairman of the department of biochemistry at the University of California, sailed last week from New York for a trip to Germany under the auspices of the Oberlaender Trust of Philadelphia. He plans to investigate methods of organization and the teaching of biochemistry in Germany, and to compare them with American methods.

DR. C. F. NOLL, professor of experimental agronomy and farm superintendent at the Pennsylvania State College, left on June 17 on a three-months tour of agricultural experiment stations. He will follow a central route westward to California, proceed north through the Pacific Coast States, and return through the northern states.

DR. EDWIN C. VOORHIES, associate professor of agricultural economics in the College of Agriculture, University of California, is in New York City to study marketing outlets in the East for honey produced in California.

THE Osler Oration before the Canadian Medical Association was delivered on June 24 by Dr. Francis R. Packard, editor of the *Annals of Medical History*.

PROFESSOR W. A. BONE, professor of chemical technology in the Imperial College of Science, delivered the Bakerian Lecture before the Royal Society on June 9, taking as his subject "The Combustion of Hydrocarbons."

PROFESSOR SIR ALDO CASTELLANI, senator of Italy, delivered an inaugural address in connection with the opening of the new Clinica delle malattie tropicali of the University of Rome, speaking on "Tropical Medicine from Ancient Times down to the Present."

By the will of the late Mrs. Frances R. Biggs, widow of the late Dr. Hermann M. Biggs, New York University receives \$100,000 to increase the funds for the Hermann Michael Biggs professorship of preventive medicine. \$35,000 is left to the Henry Street Settlement for the Hermann and Frances Biggs tuberculosis visiting nurse fund and \$1,000 to the New York Tuberculosis and Health Association. A portrait of Dr. Biggs was presented to the New York Academy of Medicine.

THE American Philosophical Society and the Geological Society of America will receive \$4,000,000 each from the estate of Dr. Richard A. F. Penrose, final adjudication of which was made on June 15. Dr. Penrose, the distinguished economic geologist, died a year ago, leaving an estate valued at \$10,040,142. Bequests included \$50,000 to the University of Chicago and \$25,000 to the Economic Geology Publishing Company.

By the will of the late Dr. W. W. Keen, Brown University, of which he was a graduate and trustee, was originally bequeathed a trust fund of \$100,000, but a codicil lowered the bequest to \$15,000, in view of the shrinkage of values.

THE *Journal* of the American Medical Association reports that with the announcement of a grant of \$1,232,652 from the Rockefeller Foundation to McGill University, for the establishment of a neurologic institute, plans for the development of a neurologic center at the school were outlined. The grant will provide for the construction of a new building, especially equipped for research in neurology, neurosurgery and the physiology and pathology of the nervous system. More than \$150,000 has been pledged by friends of the university and members of the governing board. Dr. Wilder G. Penfield, professor and head of the department of neurology at McGill, has been selected to direct the institute. Dr. Penfield was born in Spokane, Washington; he is a Rhodes scholar and a graduate of the Johns Hopkins University School of Medicine. His associates will include Drs. Colin K. Russel and Frederick H. MacKay, clinical professors of neurology, and William V. Cone, assistant professor of neurologic surgery, also a native of the United States. The new building will be erected on a site opposite the present neurologic laboratories in the Royal Victoria Hospital building. The institute will be connected with the hospital and the pathologic building by an underground tunnel. Tentative arrangements provide for the erection of a seven story building to contain wards for public, semiprivate and private rooms, operating rooms, research laboratories, offices and a few rooms for resident graduate students.

THE China Foundation with headquarters at Peiping has awarded forty-three fellowships to Chinese scientific men for the carrying forward of research work in the fields of mathematics, physics, chemistry, botany, zoology and geology. About half the fellowships are for the prosecution of work in China, carried on by research workers who have received their training abroad, or by research fellows connected with the more prominent research laboratories. This is in contrast to the situation five years ago when the fellowships of this foundation were first awarded. At that time very little research work was being undertaken in China, and most of the awards were for the purpose of enabling candidates to secure specialized training in Europe and America. The China Foundation was established in 1925 on funds of the remitted American-Boxer Indemnity. The director is H. C. Zen, of Peiping.

THE Sigma Xi Club of Peking was organized on May 20 by a group of about forty Sigma Xi alumni resident in that city. At Peking are located six large

universities, a large medical school, the Geological Survey, and other research institutions. There is evidence that Peking is growing in importance as a center of scientific research. The membership of the newly formed club, of whom three fourths are Chinese, and one fourth Americans, is connected for the most part with Tsinghua University (the American Boxer indemnity school), Yenching University (a Chinese-American private institution), and the Peking Union Medical College (Rockefeller Foundation). Officers elected for the coming year are: *President*, W. H. Adolph (Pennsylvania), professor of biochemistry at Yenching University; *Vice-president*, Y. C. Mei (Worcester), president of Tsinghua University; *Secretary-Treasurer*, A. P. T. Sah (Worcester), professor of physics at Tsinghua University.

ACCORDING to a note in *Nature*, at the annual meeting of the British Science Guild held on May 25, Sir Samuel Hoare was reelected president for the ensuing

year, and affirmed his faith in the aims of the Guild. The annual report shows a year of useful work. It is said that perhaps its most interesting feature is the attempt which the guild is making, in conjunction with the Association of Scientific Workers, to provide an adequate channel for bringing before Parliament the views of scientific men. A Science Advisory Council is being set up, and it is intended that this council shall be in some sense comparable with the Federation of British Industries, in the sense that it shall be the liaison body for providing contact with Parliament in connection with scientific and technical matters coming before the House. The success of the projected council will depend on the degree in which it enjoys the cooperation of scientific and technical societies, a number of which have already agreed to participate. The extent of its activities, however, will be mainly determined by that of the funds placed at its disposal, and in this aspect the matter has yet to be put on a satisfactory basis.

DISCUSSION

AN EXPERIMENT IN TEACHING PUBLIC HEALTH ZOOLOGY AT ROLLINS COLLEGE

IN 1892, I gave before the medical school of Georgetown University a course in medical zoology—the first of its kind in this country, so far as I have learned. Similar courses have since been introduced by a number of American medical and premedical colleges.

Very frequently the thought has occurred to me that a modification of courses on medical zoology, taking in the broader aspects of public health zoology, would present to students (besides those preparing for a medical career) an instructive and interesting study. An opportunity to try out the experiment was recently presented during my winter residence at Winter Park, Florida, after retiring from government service. President Hamilton Holt, of Rollins College, is always on the lookout for professional men retiring to Winter Park to live a life of ease and whom he can impress into special service in connection with the instruction at Rollins. Hearing that I had chosen Winter Park as locality in which to enjoy a few months as a member of the "Order of the Sons of Rest," he invited me to become a member of the winter faculty for 1932. The temptation to try out my idea of public health zoology at Rollins (which is proverbially ready to try out new ideas) induced me to accept the invitation—in spite of my conviction that the way for a man to "retire" is for him actually to retire. Probably my active colleagues in zoology will be interested in learning the results of the experiment.

Nineteen students who elected the course are preparing as follows: pre-medical 3, psychology 3, economics 3, teachers 2, mathematics 1, diplomacy 1, finance 1, business 1, welfare work 1, matrimony 2, book critic 1. They represented postgraduates, seniors, juniors, sophomores and freshmen. Eight were men, eleven were women. Taken all in all, this was the most enthusiastic and most progressive class to which I have given instruction—during forty years of special lecture work in various universities. Instruction lasted ten hours per week through the winter term. Within a week the class was "standing on tip-toes" and the students were asking for special assignments of work. Part of the instruction was given in the lecture room, part in the laboratory, part out of doors (under campus trees on the lake shore), and one afternoon per week was devoted to visiting country schools (in order to study medical inspection of the children—especially in connection with the parasitic diseases); these schools were located at various points up to about 20 miles from the campus.

The human being (*Homo sapiens*) was made the center thought; theoretical radii were drawn in all directions, representing the various phyla of the animal kingdom; every zoological subject considered was studied in its practical relations to mankind—medical, welfare, economics, national and international relations, legal, food supply, etc. One of the most popular features of the course was a study of the animals used as food in different parts of the world, for instance, mollusks, arthropods, fishes, amphibia, reptiles, birds and mammals; this gave an opportunity to study classification, biology, commerce, economics,

methods of preparation, etc., and was handled chiefly by assignments, thus turning the class into a zoological society.

The reaction of the students was most interesting. Time after time they remarked that they had no idea zoology had so many practical ramifications and could be made so interesting. For some of the students, this was their first course in zoology; others had studied zoology from one to three years in various colleges.

As nearly as I could sense the feeling of the students, they ended the course with a conviction that zoology does not consist solely of theory, Latin names, fresh and preserved animals, and chromosomes, but is actually a part—and an interesting and important part—of their daily life. To some instructors, students' interest in work is evaluated chiefly by the "marks" given; for the benefit of this class of instructor I may add that twelve students received a mark of "A"—which was based on a most critical study of the reaction by and results of the individual members of the class. So high a mark to such a large proportion of a class will seem absurd to many instructors—but even an instructor must play the game fairly with the student and by no stretch of my pedagogic conscience did I feel justified in lowering the marks, for the students had made good.

Toward the end of the term, the class elected three "honorary members," and a tree on the campus is to be dedicated to each of these three men, namely, Professor Irving Fisher (Yale), Dr. L. O. Howard (U. S. Department of Agriculture, retired), and Professor Henry B. Ward (University of Illinois). These elections were based on reviews (presented to the class) of the work of these three men in connection with public health and public health zoology.

From the results of the experiment at Rollins, I can heartily recommend public health zoology as a live subject, of interest and value to college students.

C. W. STILES

U. S. NATIONAL MUSEUM

REGARDING THE C FORMS OF KUHN

UNDER the title, "Über Bakterien und Pettenkoferien," there has recently appeared a small volume¹ by Ph. Kuhn and Käte Sternberg, of Dresden, dealing with bacterial variation and the Pettenkofer bodies (Pettenkoferia), and summarizing earlier observations in this field made since 1919.

I venture to call attention of bacteriologists interested in variation phenomena to the studies of Kuhn,

first, because they have an important bearing on the work of myself and associates with the G-forms of bacteria; and secondly, because Kuhn's publications are not commonly known in this country. The matters of special interest treated by this investigator deal with morphological variation and his conception of the parasitism of bacterial cells by a foreign micro-organism believed by him to be related to the Myxomycetes. For these parasites Kuhn has coined the name, "Pettenkoferia." Although he has extended, in an ingenious manner, this view of parasitism to include the phenomena of the bacteriophage (alleged destruction of bacteria by attack from the minute and filtrable "spores" of the Pettenkoferia), this unique portion of his exposition does not concern us further at present. I have dealt with this aspect of the problem in detail in an earlier publication.²

Kuhn's delineation of variation among the Bacteriaceae is restricted chiefly to the field of cell morphology, and here he has focused attention on five different morphological cell types which he depicts as follows:

A-forms (ameboid forms): These are chiefly round or oval bodies which may sometimes attain the astonishing size of nine microns. They are often ameboid and, in reality, represent the parasitized bacterial cells (Pettenkofer bodies). They seem to be identical with the "giant cocci," "zygospores," "balloon bodies," etc., frequently seen and sometimes reported by courageous bacteriologists for many years. They also include at least some of the so-called "involution forms" of earlier years.

B-forms (Bakterienformen): These are represented by the common rod and spiral forms that are regarded by bacteriologists as the "normal" forms of the species. These develop from the slow upgrowth of the C-forms.

C-forms (Kokkenformen): These are chiefly coccus forms although the morphology is variable, and some of the bodies are very minute. Colonies of these forms are extremely small and frequently microscopic. The C-forms arise from the B-forms.

D-forms (dendritische Formen): These are thick filaments and rods giving root-like branches that are produced by the partial fusion of independent cells or filaments. The morphology is irregular and bizarre. These forms occur among B- or F-forms.

F-forms (Fädenformen): These forms are identical with what bacteriologists term "filaments," "thread forms," or much elongated bacteria. They often produce mycelial structures. They commonly develop from the B-forms.

The designations mentioned above were employed by Kuhn to indicate the varying morphology of the cells but were not, with the exception of the C-forms,

² "The Twort-d'Herelle Phenomenon," *Jour. Inf. Dis.*, 42, 263-434, 1928.

¹ Ph. Kuhn and Käte Sternberg, "Über Bakterien und Pettenkoferien," pp. 1-52, Taf. I-XV. Gustav Fischer, Jena, 1931. See also: *Centralbl. f. Bakteriologie*, Abt. 1, Orig., 1931, Vol. 121.

definitely associated with colony features or with other specific characters.

It is possible, however, to detect from his more complete descriptions the correlation of his B-forms with the cells of the S type colony and culture; and of his F-forms with the cells of the R type colony and culture. In my experience his D-forms are also most commonly found in R cultures, and I know of no special colony form that is characteristically associated with them. It seems probable that Kuhn's A-bodies (Pettenkoferia) have been most commonly observed by others in association with a type of growth that has been termed "r-forms". r-forms are occasionally seen in *B. coli*, *B. dysenteriae*, *B. paratyphosus*, *B. anthracis* and presumably other species. Mr. Klimek in this laboratory demonstrated them in cultures of the Shiga bacillus on plates undergoing lysis. He also produced them by the action of lithium chloride, as Kuhn had done earlier.

These possible correlations between Kuhn's morphological cell types and colony form need not concern us further at present. A special significance, however, attaches to his "C-forms"; and a consideration of this point is the chief reason for the present communication dealing with Kuhn's studies.

Although I was familiar with his earlier observations and conclusions insofar as they were related to the bacteriophage phenomenon, I had not caught the true significance of his C-forms, perhaps because he reported few data on their filtrability. The matter was first brought to my attention by Dr. Schmidt-Kehl, of Würzburg, late in 1931. Since that time I have been in correspondence with Prof. Kuhn, who, in the meantime, has had opportunity to review our work on the G-forms.³ I have, in addition, examined his most recently published work, as well as reprints of certain papers published in 1929 and 1930, which Prof. Kuhn kindly sent me.

Kuhn has not reported a special study dealing with the filtrability of his C-forms. But he mentioned the circumstance that he had succeeded in passing through Berkefeld N candles the C-forms of *B. coli*, *B. typhosus*, *B. suispestifer* and *B. diphtheriae*. In ten other species he observed C-forms but the filtrability of these was not discussed. I have no doubt, however, that all of them would have proved filtrable. Despite the few data on filtration reported by Kuhn, a careful review of his published works has convinced me that the G type cultures described by us in 1931 are identical with the C-forms described by Kuhn. They are similar in manner of production (in part), in the type of colony produced, in cell morphology, in viability, in filtrability (in part), in staining charac-

³ Philip Hadley, Edna Delves and John Klimek, "The Filtrable Forms of Bacteria," *Jour. Inf. Dis.*, 48, 1-159, 1931.

teristics (gram-positive elements in young G cultures of gram-negative bacterial species),⁴ in cultural details, in lack of virulence, in resistance to bacteriophage, and in matters concerning their reversion to the "normal" type—a phase of the subject to which Kuhn has devoted special attention and with considerable success. After recently reviewing the report of our work, Kuhn shares this opinion regarding the identity of the two culture forms. It is thus not without interest that, in approaching this problem from quite different angles, we have arrived at a common result, although with different interpretations of the phenomena observed.

I cannot agree with Kuhn regarding the interpretation of these variation phenomena among bacteria (a category of variation which he reduces from a pleomorphism to a dimorphism, embracing only the B- and C-forms). I cannot agree when he states that bacteria multiply only by simple fission, for I believe that reproduction by the formation of gonidia is now well established; and it was because we believed that we could recognize the relation between the gonidial granules and the filtrable forms that we designated them "the G type cultures." Furthermore, I can not accept Kuhn's conclusions regarding the significance of the Pettenkofer A bodies, and their relation to bacteriophage lysis.

Despite these differences in interpretation, however, I believe that the observations recorded by Kuhn are, in themselves, of much value and significance. I desire, therefore, to make a somewhat belated acknowledgment of his important contributions to our knowledge of this new culture type which stands, as I believe, in an intermediate position between the filtrable, virus-like bodies and the more commonly recognized S and R type cells of many, if not all, bacterial species.

PHILIP HADLEY

UNIVERSITY OF MICHIGAN

WHALING IN NORTHEASTERN JAPANESE WATERS

At present the largest whaling station in Japanese waters is located in the Kurile Island group north-east of Hokkaido on the island of Etorofu. On the east coast of this island, in the Bay of Wannippu, whales from northern waters congregate during July and August for feeding and breeding. As far as known, this locality is one of the few places where both breeding and feeding is combined into one area. At times as many as a hundred whales have been known to come to this district in one week. It is thought that certain diatoms play an important rôle in attracting the whale to this isolated region. The

⁴ This has also been found true of certain G-forms studied by Sherman (personal communication).

feeding ground is less than ten miles from shore and is less than a mile in area.

Copulation occurs most frequently during August. At times during the breeding season the male whales can be seen in pursuit of the females. Copulation itself lasts from two to three minutes and during the process the tails of the two can be seen together above the water. A young whale is usually about ten to fifteen feet long at birth and is quite able to take care of itself in a general way. The nursing period lasts from twelve to eighteen months and so reduces the mother in weight and quality of the flesh that such an animal is valueless to the whaling industry.

The age of the whale is calculated roughly by means of the quantity of the oil secured from the bone—the larger the amount the older the whale. Life is from thirty to forty years, and the breeding season begins at about the twentieth year.

At Toshimoe, on the eastern coast of Etorofu, the Oriental Whaling Company has established a cutting-in station. As a rule, this station secures a whale a day during the breeding season. Reducing the whale to canable size is accomplished in less than an hour, an amazing speed when one remembers that an ordinary whale weighs something over 30,000 pounds! The blubber oil is used for machine oil. The best grade is secured by means of steam pressure upon the bones. Such oil is best for fine lubrication, clock and

watch oil. All parts of the whale are used, including the small intestines as food and the large intestines as fertilizer!

On the eastern coast of Etorofu the Sei whale is the most common. This whale is spotted with white, otherwise little different from the Arctic. Second in frequency is the Arctic, and rarest is the Sperm. On the west coast at Shana, where another breeding locality is found, the exact reverse is true, the Sperm whale being the most frequent, followed by the Arctic and Sei. This may be accounted for on the theory of warm waters, the east coast being in the cold stream and west coast being in the warm Japanese current. Since the establishment of the station at Toshimoe some twelve years ago, over 650 whales have been secured. Of these only twelve were Sperm, a hundred Arctic and the remainder Sei whales. Only once during the operation of the company has ambergris been found—that was off the coast of the main island of Japan, near Sendai. The profit resulting was something like \$250,000. The cause, as is well known, is due to an irritation caused by the lodging in the small intestine of a small devil fish. Such infected whales have large raw sores over the body and produce an extremely bad odor.

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SCIENTIFIC BOOKS

Flora of the Prairies and Plains of Central North America. By P. A. RYDBERG. New York Botanical Garden, Fordham Station, Bronx Park, New York, N. Y. 1932. \$5.50 postpaid.

HERE in the plains and prairies we have labored with many manuals, claimed by none, divided by many. Now we come into our own with a manual of ferns and seed plants devoting itself exclusively to us. The region covered includes "the states of Kansas, Nebraska, Iowa, Minnesota, South Dakota, North Dakota and of southern Manitoba and southeastern Saskatchewan," together with most of the species in the prairie regions to the east and west across the plains to the Rocky Mountains.

Dr. Rydberg spent many of his earlier and some of his later years in studying the plants of this region. A few years ago he set out to embody this study in a manual that would cover this region exclusively. Although death unfortunately overtook him in the midst of proof sheets, the essential part of the manuscript was complete.

I like to think that the complete purpose of a

taxonomic manual is to give names to plants, to show the relationship between plants and to furnish practicable or useful methods of identifying the plants that may be collected in the region covered by the manual.

The first of these purposes is thoroughly handled by this book, in accordance with the international code of nomenclature. The principal objection lies in the occasional "splitting" of certain well-known genera and less frequently of families. As it is a matter of opinion, therefore, of interminable argument, I can only say that the same systematic results could be obtained by using sections for the large genera and if the subrelationship is particularly necessary, the scientific name can then be written, to give but one example, *Astragalus* (*Geoprumnon*) *crassiuscarpus*. This would give the name, show the relationship and not take it quite so far from closely related plants that only the professional systematist would be able to keep track of it. This side of systematic botany, namely, practical utility, is not infrequently overlooked by the professional botanist, and yet it is

the side which is often likely to give encouragement and support to his studies. Perhaps if the elimination of the name of the person who made a change of genus were made, the tendency to split genera would be greatly reduced.

From a genetical standpoint, the arrangement of the manual is based on the Engler system, a system which is based on a preponderance of untenable propositions. To many the arrangement is of little importance, but a natural arrangement is of considerable assistance in establishing a comprehensive viewpoint in teaching taxonomy.

These points do not alter the fact that now we have concise descriptions of the 3,988 ferns and seed plants of the prairie-plains region in one book. The plants are well keyed in a standard manner. The time of blossoming or of fruiting is given and the ranges include the complete range of the plant. In

addition there is a glossary and 600 pen sketches, illustrating at least one species each of about two thirds of the genera.

Although the book is quite complete systematically, one regrets that Rydberg did not live to add the phytogeographic discussion that was planned.

A list of abbreviations of authors' names by J. H. Barnhart completes the 969-page book. This book thus fills a long-felt want and will prove indispensable for work in the region covered.

To Dr. Marshall A. Howe, of the New York Botanical Garden, goes a great deal of credit for seeing the work through publication. Particularly is this credit to be acknowledged for the great care he has taken to have the work come out as nearly perfect as possible in a field quite outside of his own.

FRANK C. GATES

MANHATTAN, KANSAS

SOCIETIES AND ACADEMIES

THE OHIO ACADEMY OF SCIENCE, 1932

THE Ohio Academy of Science held its annual meeting for 1932 at Ohio Wesleyan University, Delaware, Ohio, from April 28 to 30, with about 200 members and visitors present, the program taking the usual form of business meetings (two), a general scientific session (one), and section meetings (eleven). An outstanding feature of the general scientific session was a motion-picture film showing the treatment of osteomyelitis with blowfly larvae by Drs. D. F. Miller, C. A. Doan and E. H. Wilson, of Ohio State University. In the sectional meetings some 141 papers were presented as follows: *Zoology*, Dwight M. DeLong, vice-president, 32; *Botany*, Arthur T. Evans, vice-president, 15; *Geology*, E. M. Spieker, vice-president, 19; *Medical Sciences*, Shiro Tashiro, vice-president, 25; *Psychology*, Horace B. English, vice-president, 15; *Physical Sciences*, Forrest G. Tucker, vice-president, 21; *Geography*, Eugene Van Cleef, vice-president, 14. A few of these papers will be published in full and abstracts of many others in the July, 1932, issue of the *Ohio Journal of Science*, which issue will be devoted almost entirely to the Proceedings of the annual meeting.

The annual banquet on Friday evening was a notable event, as it was on this occasion that President Smith delivered his scholarly presidential address on "Physics and Human Experience"; the banquet was notable also in the matter of attendance and various and delightful social features.

The academy put itself on record as unanimously in favor of a water conservation survey in Ohio (H. R. Bill 6478, Senate substitute 1704), the exten-

sion of a water conservation program, the conservation and preservation of wild flowers as outlined by the Wild Flower Preservation Society and the Central Ohio Anglers' and Hunters' Club, the setting apart of suitable areas in state parks as wild life sanctuaries to be free from disturbance of natural conditions and not open to picnic or camping parties or to provision of roadways or paths, legislation to protect hawks and owls and making the use of the pole trap illegal.

Some sixty new members were elected and the following members were elected to fellowship in the Academy: S. Prentiss Baldwin, Homer G. Bishop, Albert F. Burgess, Harry F. Dietz, Winston E. Dunham, Harold A. Edgerton, Linden F. Edwards, Ray Lee Edwards, Robert M. Geist, Louis D. Hartson, Robert A. Hefner, Neale F. Howard, Ralph A. Knouff, Chester O. Mathews, Francis N. Maxfield, Zeno Payne Metcalf, Claude R. Neiswander, James Ruey Patrick, Sidney L. Pressey, John W. Price, J. P. Slesman, Isabel S. Smith, Guy Harold Smith, Laurence H. Snyder, Augustus W. Trettien, Richard S. Uhrbrock, Willard L. Valentine, Eugene Van Cleef and George W. White.

The following officers were elected for the ensuing year:

President: R. A. Budington.

Vice-Presidents: *Zoology*, W. C. Kraatz; *Botany*, Bernard S. Meyer; *Geology*, Carl Ver Steeg; *Medical Sciences*, F. A. Hitchcock; *Psychology*, L. D. Harston; *Physical Sciences*, A. A. Atkinson; *Geography*, Geo. D. Hubbard.

Secretary: William H. Alexander.

Treasurer: A. E. Waller.

To Executive Committee: Alpheus W. Smith and M. E. Stickney.

To the Joint Administrative Board of the Ohio Journal of Science: E. L. Rice and C. G. Shatzer.

W. H. ALEXANDER,
Secretary

THE TENNESSEE ACADEMY OF SCIENCE

THE Tennessee Academy of Science held its 1932 spring meeting on April 22, 23 and 24 at Memphis and Reelfoot Lake. Three sessions and the academy dinner on Friday evening, April 22, were held in the ballroom of the Peabody Hotel. Twenty-four papers were contributed by members from Memphis, Jackson, Nashville, Knoxville, and Franklin, Kentucky.

Dr. A. Richard Bliss, Jr., president, presided at the academy dinner, and Dr. Martin H. Fischer, professor of physiology in the University of Cincinnati, delivered an address on the "Constitution of Living Matter," illustrated with charts and chemical experiments. Three hundred and seventy-four members and guests were registered at the meeting in Memphis, and 154 attended the dinner.

On Saturday afternoon the non-resident members were taken in automobiles to Walnut Log Lodge, on Reelfoot Lake, where the fourth session was held that evening. The program consisted of a "Symposium on Reelfoot Lake," with special reference to its suitability as a location for a biological laboratory.

Several papers were devoted to the geographic and geologic features of the lake, its acquisition by the state for a public park and the setting apart by the 1931 General Assembly of ten acres and a building for a biological station for research, to be under the management and control of the Tennessee Academy of Science and an appropriation of \$2,500 towards outfitting.

Following these were papers by the state commissioners of education, agriculture and public health on the value of such an institution to the state, and by the president of the Southwestern University on the interest and patronage of colleges and universities.

The remarkable richness of the lake and its environs in forms of vegetable and animal life was brought out by the state forester and the state game and fish warden and by Professors Jesse M. Shaver, of George Peabody College, Clarence E. Moore, of the West Tennessee Teachers College, and A. John Schwarz, of the University of Tennessee.

Dr. A. Richard Bliss, Jr., chairman of the habilitation committee, reported that the Cantillon Club House of eight rooms would be ready for use as a laboratory early next summer, the Walnut Log Lodge near-by to be used for residence of workers.

At a meeting of the Reelfoot Lake Biological Station trustees held on the morning of April 24, an executive committee was established, consisting of A. Richard Bliss, Jr., chairman, James B. Lackey, Richard G. Turner, Jesse M. Shaver, J. T. McGill, ex-officio, and the following resolution was adopted:

That the board of trustees of the Reelfoot Lake Biological Station invite the Tennessee State Departments of Education, Agriculture and Public Health, a number of universities and colleges and selected scientific organizations, each to appoint one or more research workers to take part in a physical and biological survey of Reelfoot Lake and its environs, to begin June 1, 1932.

Each department or institution may make such provision for expenses as it deems advisable.

Reports of the work are to be made to the trustees.

JOHN T. MCGILL,
Secretary

SCIENTIFIC APPARATUS AND LABORATORY METHODS

A CONVENIENT METHOD OF PHOTOGRAPHING SMALL ANIMALS AT LOW MAGNIFICATION

DURING work on planarians I desired to take pictures of living animals in locomotion. The small size of the animals demanded pictures on an enlarged scale. Since in biological laboratories the need of photographing small living animals at low magnification frequently occurs, I will describe a method, which, in spite of its simplicity, leads to good results.

Photography on an enlarged scale requires either a relatively long exposure or a very intensive illumination of the photographed object. The intensity of the image formed by the lens on the photographic plate decreases as the square of the magnification increases. In order to take a picture of an object, *e.g.*, 5 times

enlarged, it is necessary to use an exposure 25 times longer or stronger than for a picture in natural size. If a moving object has to be photographed, then the duration of the exposure is limited. It has to be considered that the speed of the motion in the image increases at the same rate as the magnification. A planarian, *e.g.*, which glides along with an average speed of 12 cm per minute and which has to be photographed five times enlarged, will move in the image with a speed of 60 cm per minute or 10 mm per second. To obtain a sufficiently sharp picture the exposure must not be longer than 1/50 second, if we suppose that a contour appears sharp when it is not broader than 0.2 mm. Should one wish a still sharper outline, *e.g.*, not broader than 0.1 mm, one would have to shorten the exposure even more (1/100 second). The picture can not be taken except by em-

ploying an extremely strong source of light or by using proper arrangements to concentrate light on the object. This difficulty increases when the depth of focus has to be improved by choosing a small diaphragm.

The main problem in taking pictures of this kind is therefore the question of the source of light. One may use for this purpose the "Edison Mazda Photo-flash Lamp," which has recently appeared on the market. This is a glass bulb in the same shape as an electric light bulb, filled with oxygen and furnished with an aluminum foil. The aluminum may be ignited by an electric current and burns within the bulb, giving a very strong and fairly short flash (according to the statement of the manufacturers about 1/50 second).

A camera of the type of vertical cameras for microphotography has been used (Fig. 1, C). Such a

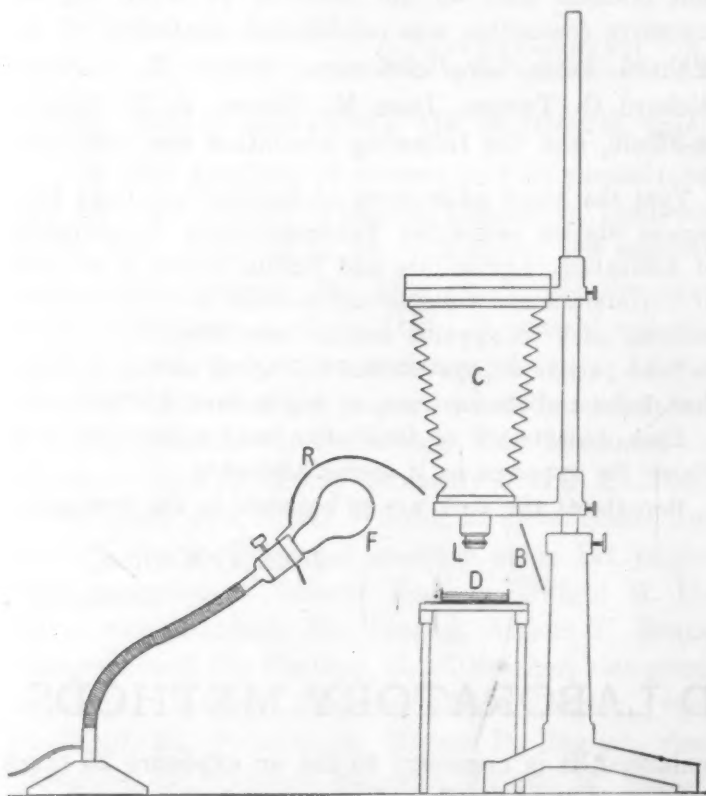


FIG. 1. Diagram of the arrangement of apparatus for taking pictures of small animals. (B) White cardboard for reflecting light; (C) camera; (D) Petri dish containing animals; (F) flash-bulb; (L) photographic lens; (R) reflector.

camera is kept in most of the biological laboratories. It combines two advantages: it allows great variation in the length of the bellows and takes pictures in a horizontal plane. Any other camera with similar characteristics will, of course, work the same way. The lower opening of the camera, which in microphotographic work is set on the eyepiece of a microscope, is closed with a photographic lens (L) with short focal length (about 5 cm). The animals are

put into a shallow dish (D), *e.g.*, a Petri dish, and placed under the lens at the proper distance. The picture is focused on the ground-glass plate with the lens entirely open. It is necessary to mark the field of vision of the ground-glass plate on the Petri dish. That may be done by putting under the dish a sheet of dark paper with a properly shaped opening. Then a flash-bulb (F) is placed close to the dish (it may be as close as 15 cm), so that its light will fall on the object obliquely from above. Care must be taken that no light falls directly on the lens or is reflected to it from the water surface. The illumination is improved by a reflector (R) fixed behind the bulb. One may use a common table lamp with a reflector, substituting the flash-bulb for the light bulb. A sheet of white cardboard (B) on the opposite side of the object may be used to increase the lighting by diffuse reflection.

After these preparations the diaphragm is adjusted in order to obtain a proper depth of focus. In an enlargement of five times and in employing ordinary double-coated plates with fine grain (and therefore with only mediocre speed) a diaphragm with an opening of $F/16$ is permissible. The ground-glass plate is changed for the photographic plate. It is convenient to work in a room with dim artificial light. Then the lens may stay open for quite a while without the plate being affected by the incident light. No high-speed shutter is necessary.

The picture is taken when an animal is moving over the marked space in the dish in proper position and shape (planarians may to a certain extent be directed in their moving by a weak source of light). The exposure is made by igniting the flash bulb by turning an electric switch.

It is often advisable to photograph a small scale with the animal. Thus one may later check the magnification in the pictures.

In photographing water animals one must take care that no dust particles are floating on the surface of the water. These could spoil the picture by forming small depressions on the surface and so destroying the sharpness of the picture locally.

This method of directly photographing small objects at low magnifications may be useful also in other cases where a short exposure of the object is necessary.

ROMAN KENK

UNIVERSITY OF VIRGINIA

PERMANENT PRESERVATION OF THE HUMAN BODY BY INFILTRATION

A METHOD for preservation of small animals by paraffin infiltration has been previously described by

Dr. G. K. Noble, of the American Museum of Natural History. This note briefly summarizes a method for permanent preservation of the human body by paraffin infiltration.

Four essential steps, well known to all familiar with histological methods, are necessary to preserve a specimen—fixation or embalming, dehydration, clearing and embedding. The different solutions used in the above steps were injected by way of heart and vascular system, and at the same time the specimen was immersed in the solutions.

The embalming fluid which maintained the color of the skin and lips most nearly normal was a solution containing liquor formaldehyde 10 per cent., sodium borate and sodium chloride each 1 per cent. Fixation required about ten days.

Dehydration and hardening was accomplished by gradually increasing strengths of alcohol. Dehydration required about forty-six days.

Xylol containing 5 per cent. of liquid carbolic acid was used as a clearing medium. Clearing required about one week.

Paraffin infiltration was accomplished by means of continued injection of paraffin through the vascular system, together with complete immersion of the body in heated liquid paraffin. Embedding required about one week.

The excess paraffin was removed with xylol and washing under running hot tap water.

In all, experience indicates that adult subjects can be preserved by the above method in about seventy days.

A still-born Negro infant has been successfully infiltrated and embalmed by the technique above described. Unlike mummies of old with their characteristic loss of color, shrinkage, removal of organs, artificial replacements, etc., this infant is preserved *in toto*, retaining its original form and identity in every respect. So natural does it appear that any one would readily mistake it for a living child.

EDMOND J. FARRIS

DEPARTMENT OF ANATOMY,
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SPECIAL ARTICLES

GENERAL THEOREMS IN DYNAMICS

I WISH to state some new and simple theorems concerning the motion of a particle in a general field of force. The proofs will be published elsewhere. The results concern the relation between the lines of force and the paths or trajectories. We consider first the case of a particle starting from rest, then a particle projected in the direction of the acting force, then an arbitrary direction.

If a particle starts from rest, it begins to move along the line of force and then deviates from it on account of its acquired velocity. The path and the line of force will, therefore, have the same tangent but different curvatures.

THEOREM I: *The main result is that the curvature of the trajectory obtained by starting from rest is one third the curvature of the line of force.*

A separate discussion is necessary when, at the given point, the curvature of the line of force is zero, as for a point of inflection, for then both curvatures vanish. In this case we consider the ratio of the infinitesimal departures of the two curves from the tangent line. In the main case this ratio would be 1:3; but now it is found to be 1:5, 1:7, 1:9, etc., depending on the order of contact with the tangent line. It is always of the form $1:2n+1$.

THEOREM II: *If the line of force has contact of n -th order with the tangent line, the trajectory produced by starting a particle from rest will also have contact of n -th order; and the ratio of the departure*

of the trajectory to the departure of the line of force from the common tangent will be $1:2n+1$.

THEOREM III: If the particle is projected in the direction of the force with a speed different from zero, the initial curvature will be zero and the departure from the common tangent will vary inversely as the square of speed.

It follows, from I and III, that if any dynamical trajectory touches a line of force it will, at that point, either have zero curvature, or else its curvature will be one third that of the line of force.

THEOREM IV: The single infinity of paths obtained by starting at a given point in the force direction with varying speed under the conditions of Theorem II, will have contact of order $n+1$, and will give departures from the common tangent varying inversely as the square of the speed; except for the single path due to zero speed for which case the contact will be of n -th order and the departure ratio will be of the form $1:2n+1$.

These theorems apply to any continuous differentiable positional field of force, conservative or not, in flat or curved spaces of any dimensionality; and therefore can be used, for example, in the gravitational field of an elliptical planet, or in the problem of three bodies, or in the complicated magnetic field of the earth.

If there is a resisting medium, like the air, Theorem I will still be valid. This is true whenever the resistance R , due to zero speed vanishes.

THEOREM V: If R_0 does not vanish, as in the case of sliding friction, the ratio of the curvatures is $1:3 + 2\frac{R_0}{F}$ where F is the acting force.

We observe that Theorem V includes Theorem I as a special case.

If a particle starts from a given point in a given general direction (not the force direction) with varying speed v , we study, in the last part of the paper, the variation of the successive radii of curvature r, r_1, r_2, \dots , and the loci of the successive centers of curvature C, C_1, C_2, \dots of the successive evolutes of the trajectories. The results for r_1 , (quartic law) and C_1 , (parabolic locus), and also Theorem I about the ratio 1:3, were given in earlier papers by the writer (Trans. Amer. Soc. Math. 1905-1910; Princeton Colloquium Lectures, *Differential geometric aspects of dynamics*, 1913; an application of Theorem I is given by W. H. Roever, *Bull. Amer. Math. Soc.*, 1915, p. 456). For r and C the results are obvious. The general results are as follows:

THEOREM VI: *The locus of C_n is a rational curve of order $n+1$. The radius r_n of the n th evolute of the trajectory varies as a polynomial of degree $2n+2$ in the speed v .*

EDWARD KASNER

COLUMBIA UNIVERSITY

SOIL WEIGHTS BEFORE AND AFTER DISPERSION

THERE appears to be a rather common belief among soil chemists and physicists that a soil, after dispersion, may weigh more than before dispersion, the dry weight at 105° to 110° C. being used as the basis of comparison. In this laboratory it was first observed, some ten to twelve years since, that, in the quantitative separation of colloidal material from soils, sometimes the total weight of the fractions into which the material was separated apparently exceeded the weight of the original sample. A somewhat similar observation has more recently been made in carrying out mechanical analyses of soils by the pipette method.¹ In this procedure the soil sample, after dispersion, is wet-sieved so that the clay and fine silt are collected in the sedimentation cylinder. By deducting the dry weight of the sands and coarse silt from the dry weight of the sample before dispersion, the weight of the material in the sedimentation cylinder may be obtained. The weight of this material may also be estimated by removing an aliquot from the sedimentation chamber, evaporating to dryness, and weighing. In practically every case where this check was made it was found that the direct determination by the aliquot method gave a slightly higher

¹ U. S. D. A. Tech. Bul. 170, p. 19.

value than did the determination by difference. It is to be noted that such difference may be occasioned by an error in the aliquot used, which error is magnified by the aliquot multiple. However, it has been usual to attribute such assumed increases of weight to combination with water when the colloidal aggregates are broken apart by dispersion and a greater total surface is exposed. The added water is sometimes spoken of as "water of hydration."

The assumption of weight increases is not wholly absurd. If, as is the usual thought, soil colloids are produced by hydrolysis of minerals, the "water of combination" of the colloids has been added by just such a process. Further, from experiments with silica gel and with charcoal, it appears that microscopic particles are exceedingly effective in condensing and holding vapors. The dispersion procedure breaks down the structure of many of the colloidal particles formed by repeated wetting and drying in the field. New particles are formed when dispersed soil is dried, and it is possible that these new particles may have a different holding capacity for water than the field particles.

It seems, indeed, quite inconceivable that the time required for soil dispersion can effect any measurable increase in the hydrolysis of unhydrolyzed minerals above that effected in the field during the almost infinite period of formation of the soil. It seems quite improbable that any addition products would be formed by dispersion, and remain stable at 105°, which can not be formed and remain equally stable under field conditions. Nevertheless, the belief in the weight increase, as noted above, seemed so general that it appeared worth while to attempt to determine whether it actually does occur. For this purpose the work reported in this report was carried out.

THE SOILS EMPLOYED

Three soils were used. The sample of Cecil clay loam was taken from the soil profile of the Erosion Experiment Station at Statesville, North Carolina. The B horizon, 6-32 inches, was used. It contains 12.1 per cent. silt and 57.1 per cent. clay. It is a lateritic soil, low in organic matter, low in base content and in exchange base capacity. The finer particles are cemented together rather firmly and it disperses with difficulty.

The sample of Beckett silt loam is a part of a profile taken in a forested area in Massachusetts. The B₂ horizon, 13-24 inches, was employed. It has 30.2 per cent. silt and 9.0 per cent. clay. The Beckett is a podsol soil and is exceptionally acid (pH=4.1) in this horizon. While it has a fairly high exchange base capacity, it is low in bases. The organic matter and iron-oxide content are both high.

The sample of Amarillo silt loam is from a profile obtained in Potter County, Texas. The stratum used was that from 10 to 20 inches in depth. It has 41 per cent. silt and 47.4 per cent. clay. The Amarillo is a chernozem soil fully saturated with bases.

The descriptions, though brief, are sufficient to show that the soils selected were developed under a wide range of climatic conditions and offer a fair range of physical and chemical characteristics. It is believed that if increase in weight, as a result of dispersion, is a phenomenon of common occurrence, it should be shown by one or more of these soils.

EXPERIMENTAL DATA

Duplicate air-dry samples, of 2.5 grams, were weighed into Erlenmeyer flask-shaped weighing bottles of 30 cc capacity. The weighing bottles were then put in a vacuum desiccator and the air removed with a vacuum pump having a rating of 0.01 mm pressure. The pressure remained constant at 4 mm for several hours under continuous operation of the pump. After 24 hours evacuation the pressure became too low to read on the manometer and was probably less than 0.1 mm. The samples were weighed on successive days until the weight became constant. Twenty-two cc of water, slightly alkaline with ammonia, were added and the flasks were shaken for 50 hours in a reciprocating shaker. The flasks were then placed in a desiccator and dried under half an atmosphere pressure at 35°. The drying was exceedingly slow. When all visible moisture had been removed, the drying *in vacuo* was completed exactly as in the initial drying. This method of drying before and after dispersion was used in order to avoid the known alteration of weight of organic matter at 105–110°. The initial and final weights are given in Table 1.

samples were allowed to stand for several days in the laboratory and then dried over night at 105° C. The changes in weight from the previous drying are given in the last two columns of Table 1. The small increases noted for the Cecil and Amarillo samples are probably due to air absorbed and the loss in the Beckett to change in the organic content.

This experiment, having failed to demonstrate the point at issue, under conditions presumably favorable to increase in weight after dispersion, if such increase actually occurs, might seem conclusive. However, soils are usually dried at 105–110° C. and therefore the experiment was repeated in modified form. For this purpose four samples of each of the soils were brought to like condition of humidity by standing in a desiccator over sulfuric acid, with a relative humidity of 65 per cent., until they ceased changing in weight. They were then accurately weighed. Each sample weighed approximately three grams. One sample of each was dispersed with 22 cc of distilled water. One of each was dispersed with 22 cc of 0.2 N. ammonium hydroxide. They were dispersed by shaking for 32 hours on a reciprocating shaker. The dispersed samples were then dried on a water bath until visible water had disappeared and were then placed in an oven at 105°. The remaining two samples of each soil were placed in the same oven under identical conditions and dried over night. The undispersed samples were in duplicate in order to show the degree of accuracy obtainable. The experimental results are given in Table 2.

Instead of recording in the table the actual initial weights of the samples, the data are recalculated on the basis of exactly 3 grams each and the oven-dry weight corresponding to this given in column 5. The last column in Table 2 gives the difference between the oven-dry weight and the mean value of the un-

TABLE 1
VACUUM-DRIED SOIL WEIGHTS BEFORE AND AFTER DISPERSION

Lab. No.	Soil series	Initial weight by vacuum drying		Final weight by vacuum drying after dispersion		Change in weight after dispersion		Change in weight at 105° C.	
		Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
		gm	gm	gm	gm	gm	gm	gm	gm
6978	Cecil	2.4583	2.4580	2.4599	2.4597	+0.0016	+0.0017	+0.0031	+0.0036
4447	Beckett	2.4596	2.4607	2.4590	2.4600	-.0006	-.0007	-.0055	-.0038
4575	Amarillo	2.4169	2.4166	2.4207	2.4211	+0.0038	+0.0045	+0.0039	+0.0039

It will be observed that the results are essentially negative. That is, the weight changes are very slight and of the order of magnitude of the unavoidable errors of the experiment. The maximum increase is but 0.16 per cent. After the final vacuum drying the

dispersed samples. It may be observed that the deviations of the dispersed samples are of the same order of magnitude as those of the single undispersed samples, the largest being but 3 mg. The total dry weight of the dispersed samples is but 1 mg. less

TABLE 2
CHANGE IN WEIGHT OF SOILS AT 105° C.

Lab. No.	Soil series	Sample treatment	Initial weight	Oven dry weight	Deviations from average oven dry wt. of moisture samples
			gm	gm	gm
6978	Cecil	Air dry (1)	3.0000	2.9231	+0.0003
"	"	" (2)	3.0000	2.9225	-0.0003
"	"	Dispersed with ammonia	3.0000	2.9258	+0.0030
"	"	Dispersed without ammonia	3.0000	2.9241	+0.0013
4447	Becett	Air dry (1)	3.0000	2.9294	+0.0005
"	"	" (2)	3.0000	2.9304	-0.0005
"	"	Dispersed with ammonia	3.0000	2.9300	+0.0001
"	"	Dispersed without ammonia	3.0000	2.9278	-0.0021
4575	Amarillo	Air dry (1)	3.0000	2.8106	-0.0015
"	"	" (2)	3.0000	2.8136	+0.0015
"	"	Dispersed with ammonia	3.0000	2.8114	-0.0007
"	"	Dispersed without ammonia	3.0000	2.8110	-0.0011

than that of the undispersed samples. On the basis of this experiment, therefore, if any weight change occurs as a result of dispersion, it does not exceed 0.1 per cent. It is to be observed that a very small increase in weight should occur in acid soils dispersed with ammonia, since ammonia adds itself directly to acids and this addition has been repeatedly demonstrated in soils. In the case of the Cecil sample such an increase is noted. The total base capacity of the Cecil is about 1 milliequivalent per gram and the absorption of this quantity would mean an increase in the sample used of 2.5 milligrams. No such difference should occur in the Amarillo soil and indeed the difference between the weights of the sample dispersed in ammonia and that in water is less than that of the undispersed samples. The Beckett soil is also unsaturated like the Cecil, and shows a difference of about 2 mg between the sample dispersed in ammonia and that in water. Both show negative values which are probably properly ascribed to loss of organic matter during the evaporation of the dispersed material. The differences in the weight of the undispersed samples, while not large, are probably due to actual lack of uniformity in the samples themselves which were sieved to pass a 2 mm sieve. Closer duplication might have been secured by finer grinding of the material.

The results obtained are essentially negative. There is no appreciable increase in weight of dry samples as a result of dispersion in water. The writers realize, of course, that as soils are ordinarily dispersed, much greater dilutions of soil by water are employed. The concentrations employed were used in order to minimize any possible loss in handling. It seems improbable that greater dilution would give greater

hydration. Also, while in the normal process of dispersion the colloid and coarser material are dried and weighed separately, there would seem, especially in soils so high in clay as these employed, to be no reason why separate drying should alter the matter. The writers are also aware that these experiments do not prove that hydration of soils by dispersion never occurs. They do show that if such result were common and of appreciable magnitude, it should have occurred in the soils examined. It seems desirable to put the results on record and to request that, if any soil worker can furnish reproducible data to show that increase in the dry weight of soils results from dispersion, he will likewise communicate the results. It is worth while to determine whether the thing is mythical or if it constitutes a real excuse for inaccurate data.

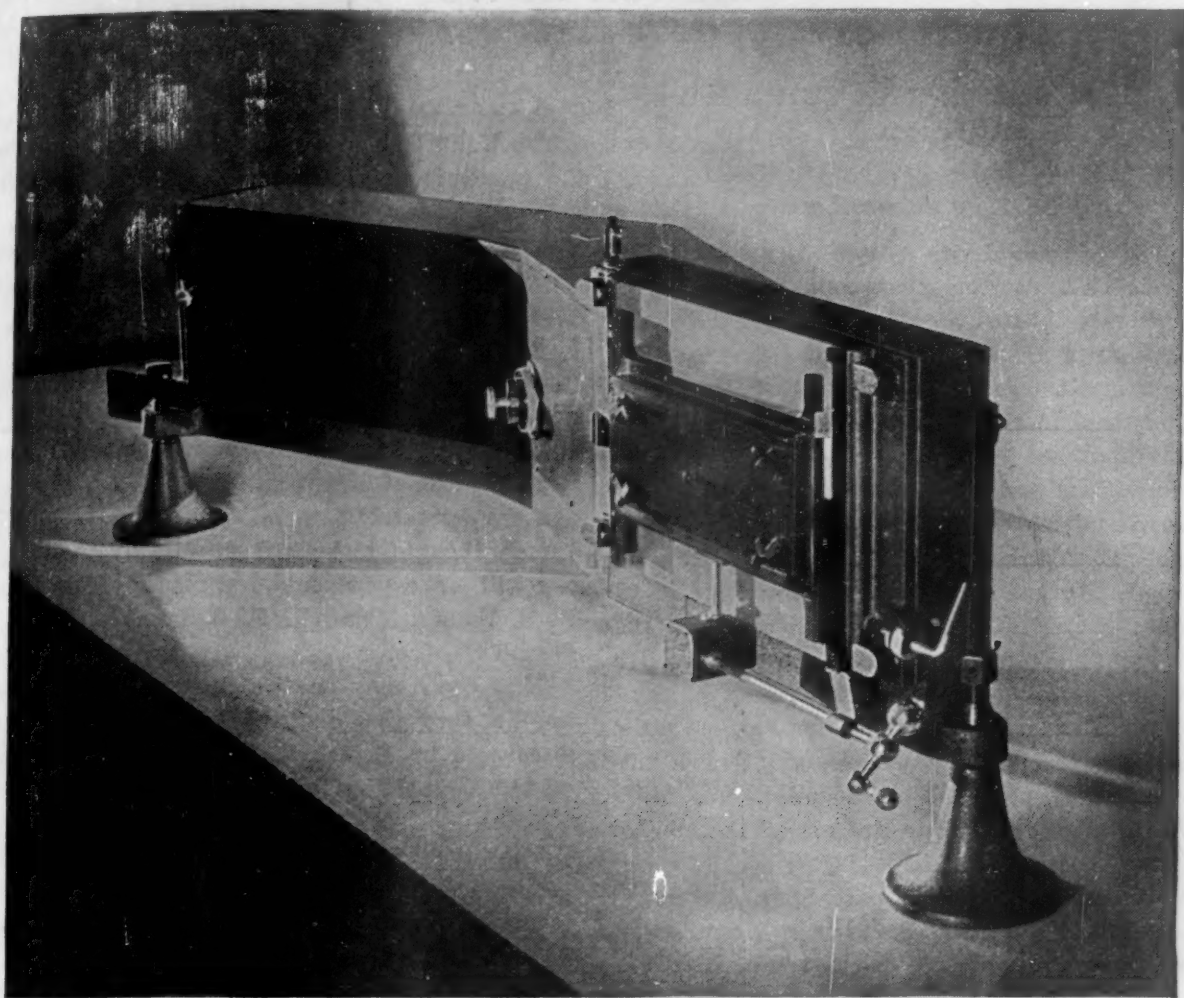
L. B. OLMSTEAD

HORACE G. BYERS

BUREAU OF CHEMISTRY AND SOILS,
U. S. DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

BOOKS RECEIVED

- BÉHAR, M. F. *Fundamentals of Instrumentation*. Pp. xiii + 109. 48 figures. Instruments Publishing Company, Pittsburgh. \$2.00.
- BAITSELL, GEORGE A. *Manual of Animal Biology*. Pp. xiii + 382. Illustrated. Macmillan. \$2.50.
- CURTIS, HARRY A., Editor. *Fixed Nitrogen*. Pp. 517. 82 figures. Chemical Catalog Company. \$12.00.
- LASHLEY, K. S., Editor. *Studies in the Dynamics of Behavior*. Pp. xiv + 323. Illustrated. University of Chicago Press. \$5.00.
- MITCHELL, PHILIP H. *A Text-Book of General Physiology for Colleges*. Second edition. Pp. xviii + 799. 196 figures. McGraw-Hill. \$6.00.
- Report of the National Research Council of Japan, No. 8-9, 1928-1930*. Pp. 229-350. The Council, Tokyo.
- ZUCKERMAN, S. *The Social Life of Monkeys and Apes*. Pp. xii + 356. 24 illustrations. Harcourt, Brace. \$3.75.



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SCIENCE NEWS

Science Service, Washington, D. C.

SOME ADVANCES IN THE SCIENCES
DURING 1931

(Continued from the issue of December 25)

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Biology

BACTERIA, visible under the microscope, were changed to invisible, filterable phases when Dr. Arthur I. Kendall, of the Northwestern University Medical School placed them in a new medium containing protein; he was also able to return them to visible form, and grew filterable viruses in the new medium, and, through the new Rife microscope, saw them as tiny oval blue bodies.

A new weapon to combat the dread disease paresis was made available to medicine when Dr. Frederick Eberson and William G. Mossman, of Mount Zion Hospital in San Francisco, succeeded in growing artificially in the laboratory a harmless germ capable of causing a curative fever without itself producing any disease.

Six generations of the organism causing infantile paralysis were for the first time successfully grown outside the human body at Mt. Zion Hospital, San Francisco, by Dr. Frederick Eberson, director of the clinical laboratories.

The first United States plant patent was issued to Henry F. Bosenberg, of New Brunswick, New Jersey, for an everblooming rose derived from the familiar Van Fleet.

A true "plague of locusts" descended on parts of the West during the summer, in one of the worst "grass-hopper years" of recent record; locusts were also troublesome in parts of the Old World.

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SCIENCE NEWS

Science Service, Washington, D. C.

SOME ADVANCES IN THE SCIENCES
DURING 1931

(Continued from the issue of December 25)

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Biology

BACTERIA, visible under the microscope, were changed to invisible, filterable phases when Dr. Arthur I. Kendall, of the Northwestern University Medical School placed them in a new medium containing protein; he was also able to return them to visible form, and grew filterable viruses in the new medium, and, through the new Rife microscope, saw them as tiny oval blue bodies.

A new weapon to combat the dread disease paresis was made available to medicine when Dr. Frederick Eberson and William G. Mossman, of Mount Zion Hospital in San Francisco, succeeded in growing artificially in the laboratory a harmless germ capable of causing a curative fever without itself producing any disease.

Six generations of the organism causing infantile paralysis were for the first time successfully grown outside the human body at Mt. Zion Hospital, San Francisco, by Dr. Frederick Eberson, director of the clinical laboratories.

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Recognitions and Awards

The Nobel Prize in chemistry was divided between Dr. Friedrich C. R. Bergius, of Heidelberg, and Dr. Carl Bosch, head of the German I. G. Farbenindustrie, for their development of the hydrogenation process of "liquefying" coal to obtain motor fuels, lubricating oils, methanol and other chemical substances.

The Nobel Prize in medicine for 1931 was awarded to Professor Otto Warburg, of the Kaiser Wilhelm Institute for Biology, Berlin, for his important contributions in the fields of cancer, biological physics and the respiratory function of the tissues.

Dr. William Wallace Campbell, director emeritus of the Lick Observatory and president emeritus of the University of California, was elected president of the National Academy of Sciences.

Dr. Franz Boas, of Columbia University, anthropologist, was elected president of the American Association for the Advancement of Science.

The Perkin Medal was awarded by the American section of the Society of Chemical Industry to Dr. Charles F. Burgess, of the Burgess Laboratories, Madison, Wis.

The Rumford Medal was awarded by the American Academy of Arts and Sciences to Professor Karl T. Compton, president of the Massachusetts Institute of Technology.

For his researches on plant cultivation, including the taming of the wild blueberry, Dr. Frederick V. Coville, of the U. S. Department of Agriculture, was awarded the George Robert White Gold Medal of honor by the Massachusetts Horticultural Society.

The 1931 Catherine Wolfe Bruce Gold Medal of the Astronomical Society of the Pacific, for "distinguished services to astronomy," was awarded to Dr. Willem de Sitter, Dutch astronomer. The Royal Astronomical Society's Gold Medal was given to Dr. de Sitter.

For their contributions to science in finding methods of accurately counting the years back many uncalendared centuries, Dr. A. E. Douglass, of the University of Arizona, and Dr. Ernst Antevs, of the University of Stockholm, were given the Research Corporation plaque and prize of \$2,500.

Dr. Phillip Drinker and L. A. Shaw, inventors of the Drinker Respirator, which has proved invaluable in the treatment of infantile paralysis, asphyxiation and diseases of the lungs, were awarded the John Scott Medal by the City of Philadelphia.

The Gold Medal of the American Medical Association was awarded this year to Dr. Jacob Furth, of the Henry Phipps Institute of the University of Pennsylvania, for his original investigative work on experimental leukemia, a fatal disease characterized by an increase of white blood corpuscles in the blood.

The Capper Award, founded by Senator Arthur Capper, of Kansas, consisting of a gold medal and five thousand dollars cash, was given to Dr. L. O. Howard, former chief of the Bureau of Entomology, for his distinguished service in leading the army of science against the armies of insects that threaten man's crops, his forests, his house and his health.

Franklin Medals were presented to Sir James Jeans, British astronomer, and Dr. W. R. Whitney, director of

the research laboratories of the General Electric Company.

The Willard Gibbs Medal was given to Dr. P. A. Levene, of the Rockefeller Institute for Medical Research, for his application of organic chemistry to biologic problems, especially in nucleic acids, amino sugars and lecithins.

The Frederick Ives Medal of the Optical Society of America was awarded this year to Professor Theodore Lyman, of Harvard University, for his pioneer work in the ultra-violet spectrum of glowing hydrogen gas.

Dr. Henry Fairfield Osborn, president of the American Museum of Natural History, New York, was given the Daniel Giraud Elliot Medal for 1929 awarded this year by the National Academy of Sciences in recognition of his monograph: "The Titanotheres of Ancient Wyoming, Dakota and Nebraska."

Linus Pauling, of the California Institute of Technology, who has made important applications of the quantum theory to chemistry, was the first recipient of a new award given by the American Chemical Society for research in pure chemistry conducted by persons under 31 years of age.

The 1931 Edison Medal of the American Institute of Electrical Engineers was awarded to Dr. Edwin Wilbur Rice, Jr., of the General Electric Company, pioneer in electrical engineering.

The first annual award given as a memorial to Dr. Thomas W. Salmon went to Dr. Adolph Meyer, psychiatrist of the Johns Hopkins Hospital, who delivered the Salmon Memorial lectures for the year and received an honorarium of \$2,500.

Dr. Harlow Shapley, astronomer and director of the Harvard Observatory, and Dr. William Crocker, botanist and director of the Boyce Thompson Institute for Plant Research at Yonkers, were the recipients of the 1931 medals for outstanding scientific achievement given by the Society of Arts and Sciences.

C. W. Tombaugh, young assistant at the Lowell Observatory who first observed the trans-Neptunian planet, Pluto, was honored by the award of the Royal Astronomical Society's Hannah Jackson gift and medal.

For their paper on high voltage tubes, Dr. M. A. Tuve, Dr. L. R. Hafstad and Odd Dahl, of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, were awarded the \$1,000 prize at the Cleveland meeting of the American Association for the Advancement of Science.

The National Academy of Sciences awarded the Mary Clark Thompson Medal to Dr. Edward Oscar Ulrich, of the U. S. Geological Survey, for his outstanding contributions to geology and paleontology.

The first annual prize of \$10,000 to be given by the *Popular Science Monthly* was divided between Dr. George H. Whipple, of the University of Rochester School of Medicine and Dentistry, and Dr. George R. Minot, of the Harvard University Medical School, for their development of the liver treatment of anemia.

The American Chemical Society's Nichols Medal was presented to John Arthur Wilson, industrial chemist of Milwaukee, Wisconsin, for his outstanding achievements in colloid chemistry.

New McGraw-Hill Books

Pratt's THE MEANING of MUSIC

A Study in Psychological Aesthetics

By **Carroll C. Pratt**, Assistant Professor of Psychology and Tutor in the Division of Philosophy in Harvard College. 253 pages, 5 x 7½. \$2.00

This book by one who is both psychologist and musician aims to discover the source of music's wide appeal. In supporting the thesis that, more than any other art, music is a language of emotion, the author goes deeply into the materials and forms of music, presenting thoughtful approach to many topics of interest to the psychologist, the aesthetician, and the musician.

Achilles' PSYCHOLOGY AT WORK

By **Lois Hayden Meek**, **Floyd H. Allport**, **Morris S. Viteles**, **Walter R. Miles**, **Arthur I. Gates**, **Arnold Gesell**, **Mark A. May**. Edited by **Paul S. Achilles**. *Whittlesey House Publication*. 260 pages, 5½ x 8½. \$2.50

The purpose of this book is to give a well-rounded picture of the practical uses to which psychology is being put in such fields as industry, child training, the professions and political science. Seven interesting, non-technical articles—lectures delivered under the auspices of the Psychological Corporation, by well-known psychologists—give the reader a cross-section of this science in its newer, fuller aspects. This book is the Scientific Book Club selection for January.

Bentley and Humphreys' SNOW CRYSTALS

By **W. A. Bentley** and **W. J. Humphreys**. 227 pages, 9 x 12, reproductions of over 2000 photomicrographs. \$10.00

This book makes generally available a representative selection of more than 2000 photomicrographs of snow crystals and kindred forms of water. These are from the collection of **W. A. Bentley** who has specialized in the making of these photographs for more than 40 years. Introductory text matter by **W. J. Humphreys** gives the procedure followed in making the photographs and other interesting facts regarding them.

Chapman's ANIMAL ECOLOGY

With Special Reference to Insects

By **Royal N. Chapman**, Dean of the Graduate School of Tropical Agriculture and Director of the Pineapple Experiment Station, University of Hawaii; Formerly Professor of Zoology and Entomology, University of Minnesota. *McGraw-Hill Publications in the Zoological Sciences*. 464 pages, 6 x 9, illustrated. \$4.00

This book brings together in a formal and logical statement the various and diverse materials embraced by the subject of ecology. The viewpoint is quantitative and experimental; the object is not only to call attention to what has been done in the past, but to point out the field in which there is a reasonable prospect of advance in the future.

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330 West 42nd Street

New York

SCIENCE NEWS

Science Service, Washington, D. C.

ISOTOPES OF HYDROGEN

THE recently heralded discovery of a new and heavier kind of hydrogen atom was anticipated by Professor Fred Allison, of the Alabama Polytechnic Institute, one of the contestants for the honor of discovering the missing chemical elements 85 and 87.

The discovery was reported to the American Chemical Society in September prior to the announcement last week of the spectroscopic detection of the new kind of hydrogen by Professor Harold C. Urey and Dr. G. M. Murphy, of Columbia University, and Dr. F. G. Brickwedde, of the U. S. Bureau of Standards. Details of Professor Allison's work will be published in a forthcoming issue of *Industrial and Engineering Chemistry*.

No separation of the two kinds of hydrogen was made by Professor Allison. Dr. Brickwedde, however, concentrated the heavier constituent of the gas five-fold. Professor Urey's measurements on the hydrogen spectrum agree with the estimate of Professor Allison in giving the proportion of the new double-weight hydrogen as about one atom to 4,000 of ordinary hydrogen.

The new and still disputed magneto-optic method of chemical analysis, on which Professor Allison bases his claims to the discovery of the missing elements, was also used in detecting hydrogen of atomic weight two. This method can detect as little as one part of a substance in a hundred million, and also it will separately identify isotopes, the atoms of different weight which make up many of the common elements. Tests show that, with one or two exceptions, the number of isotopes, revealed by Professor Allison's new method, is identical with that found by other means. This establishes the value of the method.

Professor Edna R. Bishop and Margaret Lawrenz, of the Alabama Experiment Station, have also shown by a study of uranium and thorium leads by the Allison method that the different isotopes are singled out in the order of their abundance.

Last year Professor Allison announced that seven heavy, metallic elements, including gold and platinum, are actually mixtures of isotopes previously undetected. This claim, like the other fruits of his magneto-optic method, has still to be verified by other investigators.

Professor Allison's paper giving his proof of the hydrogen isotopes will read in part as follows: "These results would be in accord with those of other metals if two isotopes of hydrogen are postulated. Quantitative experiments recently carried out on . . . acids and water, interpreted upon this postulate, indicate without exception that the lighter isotope is far more abundant, very roughly in the ratio of several thousand to one, and further that, . . . the mass of the heavier isotope is probably two, though the evidence as to the exact mass is not conclusive. We are unable to suggest any explanation of these doublets unless it be upon the hypothesis of two isotopic components of hydrogen."

LIGHT FROM RECEDING NEBULAE

THOUGH it is apparently receding from the earth at the speed of 11,700 kilometers (nearly 7,300 miles) a second, the light from the group of faint nebulae in the constellation of Ursa Major, the great bear, reaches us at the usual rate of about 186,000 miles a second. This has been ascertained by Dr. Gustaf Strömberg, of the Mount Wilson Observatory, by measurements of what is called the aberration constant.

The aberration of a star is its apparent displacement due to the earth's motion. The earth is moving around in its orbit at a speed of about 18 miles a second, which is a small, but appreciable, fraction of the speed of light. When the earth is moving at right angles to the direction of the star, which is when the star is on the meridian at midnight, the telescope itself, being carried along with the earth, moves a few feet while the light is passing from one end of the telescope to the other.

The result is that the telescope must be pointed slightly in advance of the star's real position. An analogous condition occurs when walking through the rain with an umbrella. If the rain is falling vertically, and one is standing still, the umbrella is held directly overhead. But if one is walking along, even though the rain is still falling vertically, the umbrella must be tilted forward, for then, after the rain drops have fallen below the level of the umbrella, the person advances forward to meet them.

By means of photographs of these faint nebulae, which are supposed to be at the vast distance of 70 million light years, Dr. Strömberg measured their aberration. He found that it is practically the same as with stars, so that the fact that these nebulae are receding from us does not affect the speed of their light through space. This is what was expected, for ever since the famous Michelson-Morley experiment, which started the groundwork of the relativity theory, it has been supposed that light has the same velocity anywhere, regardless of the motion of its source, or of the observer.

A MARTYR TO TYPHUS FEVER RESEARCH

BECAUSE he found that a bit of chiffon laid over the end of a glass tube made it possible for experimental fleas to bite typhus fever-infected guinea-pigs, Dr. Elmer T. Ceder, 26-year-old research assistant at the U. S. National Institute of Health, is now lying on a hospital bed fighting the disease in his own body.

Fortunately this latest martyr to science is not critically ill and is expected to recover. The American typhus fever, from which he suffers, is not so fatal as the European form of the disease. Most of the fatal cases of supposed typhus fever in this part of the world have turned out to be Rocky Mountain spotted fever, according to investigations made by Drs. R. E. Dyer, L. F. Badger and A. S. Rumreich, of the National Institute of Health. It was in part of this very research that Dr.

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Ceder was assisting when he fell a victim to typhus fever.

Dr. Dyer, investigating the two diseases as they occurred in the city of Washington and near-by states, found among other things that fleas apparently transmitted one of the diseases which was presumably typhus fever. To prove this, it was necessary that he have uncontaminated fleas feed on animals infected with typhus fever and then have the same fleas feed on uninfected animals. If the animals caught the disease, he could prove that the fleas had transmitted it. However, he struck a snag in his investigations when he tried to get the fleas in their sterile glass tubes to bite the guinea-pigs.

When young Dr. Ceder joined the staff of the National Institute of Health he was set at this task which became one of his main jobs. Dr. Ceder discovered that the fleas in the glass tube could not bite because the slippery sides of the tube gave them no foothold for their legs. So he ingeniously covered the ends of the tube with a piece of chiffon which gave the fleas a good surface to anchor themselves to while they bit and sucked the pigs' blood.

In the course of his work, one of the infected fleas bit Dr. Ceder instead of the pigs, it is thought, thus giving him the disease. This young research worker has thus contributed in two ways to science's knowledge of typhus fever. First, he advanced the laboratory research on the transmission of typhus fever in animals and second, he has given conclusive, if unintentional, proof that it is also transmitted to man by fleas.

Dr. Ceder was born in Minneapolis in 1905 and received his medical degree from the University of Minnesota in 1929. He served his internship in one of the U. S. Public Health Service hospitals and was assigned to duty in Pittsburgh as an officer of the service. He was transferred to the National Institute of Health early in 1931 because he gave promise of developing into a valuable research worker.

THE TUBERCULOSIS GERM

DR. RALPH MELLON, of Western Pennsylvania Hospital's Institute of Pathology, Pittsburgh, announced to the Society of American Bacteriologists, meeting in Baltimore, that the tuberculosis germ has a double life and can shrink itself into a dwarf form beyond the visibility of ordinary microscopes.

This new chapter in the life cycle of the microscopic bearer of the great "white plague" may explain the disputed action of BCG, the living vaccine against tuberculosis developed in France, and it may throw light on ills similar to tuberculosis, such as Hodgkin's disease.

Dr. Mellon found that ordinary tubercle bacilli, which are slender rod-like organisms, may develop under suitable living conditions into granules which have much less ability to produce the disease. These granules are ultra-microscopic and pass through the finest filters but may be brought back to a visible form when fed proper food. The ordinary germs are called acid-fast because they retain a red stain even when washed in acid, and the

granules are also acid-fast. The granules in turn may develop into the ordinary acid-fast, virulent tubercle bacilli, or they may develop into other bacilli which are not acid-fast and not virulent and which Dr. Mellon finds look like the bacilli that cause diphtheria.

The existence of such a minute, filterable form of the tuberculosis germ has been the subject of scientific controversy for nearly a decade. No one until this time has succeeded in cultivating it from a growth of a single bacterial species.

Dr. Mellon warned that even though the familiar form of the tubercle bacillus may disappear from the tissues of the body, danger still threatens the patient from the possible unsuspected presence of one of the variant forms of the germ which may at any time develop disease-producing powers.

ARTIFACTS OF SINANTHROPUS

SINANTHROPUS, or "Peking Man," knew the use of fire. Specimens of apparently charred animal bones have been recovered from the limestone deposits at Choukoutien, the locality about forty miles southwest of Peiping where the Sinanthropus remains were found. The physical appearance of these specimens made it fairly evident that they had been subject to the action of fire, but the origin of the fire was not known. It remained a question whether the bones had been burned within the Choukoutien Caves while the latter were occupied by Sinanthropus or whether they were burned in a surface fire from natural causes and had subsequently been washed into the deposit.

Several of the charred bones were sent to Paris for comparison with similar specimens which have been found in abundance in many of the prehistoric sites in Europe, and Dr. Gaubert, of the laboratory of mineralogy of the Paris Museum, subjected some of these fragments to chemical analysis. These results of his experiments, taken in conjunction with an analysis of soil samples from the Choukoutien Caves, have now made it plain that it was Sinanthropus who carried the fire into his subterranean dwelling.

Last spring W. C. Pei, the young Chinese geologist who found the famous Sinanthropus skull in 1929, collected from the Choukoutien deposits more than 2,000 quartz artifacts. These corresponded to the pre-Chellean type of implement found in Europe, but in technique they resembled the Mousterian culture in that they were made from quartz flakes rather than from cores. As these implements were found in association with Sinanthropus remains, consisting of a skull fragment and two additional jaw specimens, besides numerous animal fossils, it is considered certain that they represent the handiwork of the Peking Man.

Discussing the Choukoutien culture in a paper before the Chinese Geological Society, Abbé Henri Breuil, director of research in the Institute of Human Paleontology in Paris, who recently visited Peiping, pointed out that Sinanthropus must have made a considerable use of fire, as superimposed layers of charcoal-débris extending to a depth of seven yards were found, while many

stones were seen to be black with soot. It was evident that he used the stone implements for fashioning weapons from animal bones. Deer antlers with sharpened points, which had been found on the site, might well have been used as daggers, while the frontal portion of a deer skull looked as though it might have been used as a drinking vessel.

Among the artifacts Abbé Breuil was able to identify side scrapers, points, piercers and borers, all testifying to "a very systematic industry." Larger fragments resembled choppers or anvils. The quartz from which the implements had been made was a very imperfect material, Abbé Breuil pointed out, but *Sinanthropus* seemed to have done about as well with it as any one could be expected to do. At any rate it was clear that *Sinanthropus* was already man and that he was able to organize his life so as to select intelligently the elements useful for burning, for cutting and for working. Probably he was able to work in wood as well as in bone, but this is difficult to prove. Unquestionably, too, he was a successful hunter of animals.

OCEAN BOTTOM TO GUIDE NAVIGATION

THE ocean bottom replaces the heavens as guide to the navigator over Georges Bank, which lies off the New England coast, with the issuing by the U. S. Coast and Geodetic Survey of a new chart describing the floor of the ocean in this region.

Instead of "shooting the stars" to keep their ships on a true course, captains of transatlantic liners during the most dangerous part of their voyage will compare readings of their echo depth-finder with a map of the bottom of the sea. So well does the map describe the hills and valleys beneath the water and so accurately can the depth-finder report their size that the navigator will be able to determine his position by speedy soundings and so keep on the right course.

With this method of navigating the frequent fogs over Georges Bank will no longer make dangerous the many hills on the ocean bottom that rise close enough to the surface to ground ships.

The new chart is the result of surveys of the past two summers which have covered two thirds of the 30,000-square-mile submerged continental shelf. Work on the chart was speeded up following insistent requests from shipping men. The Coast and Geodetic Survey expects to complete the survey next year.

A large submarine valley, longer and deeper than Corsair Gorge discovered during 1930, was found by surveys of the past summer and is shown on the chart. The new valley, which has not been named, cuts back into the southern edge of the Bank about eleven miles and is roughly two and a half miles wide and 2,000 feet deep. The tops of its ridges are only 600 feet below the surface of the ocean, while at its mouth on the edge of the shelf the depth drops off abruptly to 6,000 feet. Two small indentations were also found.

ITEMS

THE kind of phonograph recording used by Edison in his original work promises to return to practical use and

produce the most faithful reproductions of music. Mr. Halsey A. Frederick, of the Bell Telephone Laboratories, demonstrated to the Society of Motion Picture Engineers and the Institute of Radio Engineers new disc records cut by the vertical method instead of the lateral method used in ordinary phonographs. The new system of music reproduction is claimed to eliminate needle scratch. The material of the new disc records is cellulose acetate, the same substance that is used in making cellophane, rayon and other new products of synthetic chemistry.

Fogs are colorless in Rochester, New York, whatever they may appear to be in London, according to experiments of F. M. E. Holmes and Dr. Brian O'Brien, of the Institute of Optics of the University of Rochester. Many investigators have, since the time of Lord Rayleigh, believed that red or yellow light passed more easily through fog or haze than blue, green or violet. Most of the light scattered by the water droplets of the Rochester fog, however, contains all colors equally. Only a small fraction, that scattered by the air itself in the mile-long path of the light, obeyed the law given by Rayleigh. The blue of the sky is explained by Rayleigh's formula which states that the amount of any color scattered by fine particles is proportional to the fourth power of the vibration frequency of that color. This is true on clear nights, Mr. Holmes and Dr. O'Brien found, when only very faint haze in the air has to be taken into account. For a fog, however, which consisted of droplets $1/500$ inch in diameter, only one eightieth of the scattered light showed this behavior. The rest is absorbed by the fog to an extent which is independent of its color.

ALCOHOL made from wood—not wood alcohol—by an improved method in England, is declared commercially practicable where sawdust can be obtained at a dollar a ton or less and a supply of 200 tons a day is available. The process, which will recover from 35 to 40 gallons of alcohol per ton of dry sawdust, was worked out by Dr. Harold A. Auden and Dr. Walter P. Joshua, of the Distillers' Company Research Laboratory at Epsom. The process consists in forcing acidulated water, containing two parts of sulphuric acid per thousand, at a temperature of 180 degrees Centigrade and a pressure of twelve atmospheres, through sawdust packed in lead-lined vessels. Under these conditions nearly half of the sawdust is changed into fermentable sugars. The molasses thus obtained is fermented with yeast in the usual way to obtain the alcohol.

LONDON'S huge rubbish heap which has been accumulating near Dagenham for many years will be used as fuel instead of coal in boilers of a new Ford motor plant, Dr. Ernest W. Smith, English combustion engineer, states. Sixteen cells for burning the refuse are being built, which will consume 300 tons of waste a day to produce steam at 1,200 pounds per square inch pressure and 1,100 degrees Centigrade, which can be used for heating, for producing electricity or in manufacturing processes. The refuse is claimed to have a heat value of 3,000 British thermal units in summer and 4,000 in winter compared with values ranging from 12,000 to 15,000 units for the best coals.

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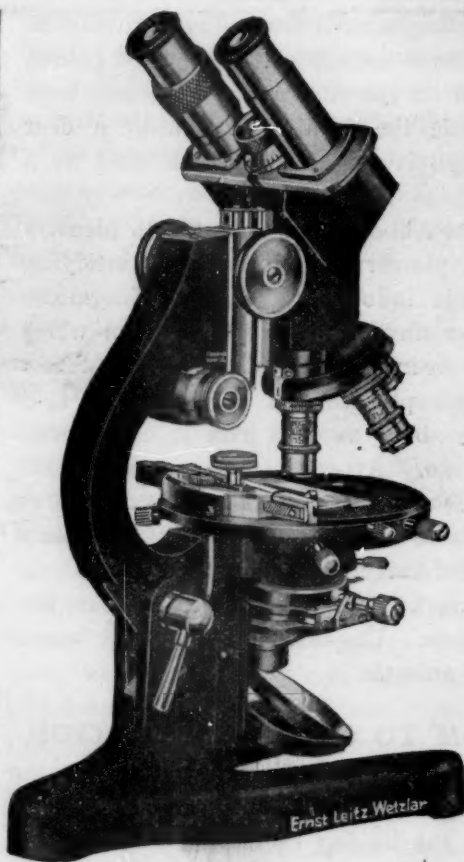
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SCIENCE NEWS

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MARINE VEGETATION IN UTAH ROCKS

ABOUT 500,000,000 years ago there grew in what is now Logan Canyon, Utah, masses of vegetation so abundant as to rival the most luxuriant growths of seaweed anywhere along our coasts to-day, according to observations made on a field exploration trip last summer by Dr. G. R. Mansfield, of the U. S. Geological Survey, and Professor Reed W. Bailey, of the Utah State Agricultural College.

Professor Bailey, the discoverer, guided Dr. Mansfield to this place where evidences of plant life in early geologic time were preserved in unusual profusion. On the west side of the main canyon just below the mouth of the Right Fork two great blocks of sandstone, each weighing several tons, had slid down hill from a ledge above and lay by the side of the road. They had turned bottom up in the process and displayed a mat of vegetation of the type usually called fucoids.

"Few, if any, traces of the original plant substance now remain," Dr. Mansfield explained, "but the sand which sifted into the tangle of vegetation as it lay on the sea bottom formed molds which were filled by later supplies of similar sand. Then the whole mass was buried beneath beds of sand and limy muds. As time went on these in turn gradually solidified into sandstones and limestones, which have since, by changes in the earth's crust, been raised above the sea and subjected to stream erosion and weathering."

Marine vegetation was undoubtedly one of the very first types of life to inhabit the earth. Indirect evidence of its presence in early times has been found in flakes or accumulations of graphite obtained here and there among crystalline rocks (schists) that were formed before the beginning of the Cambrian period, the time when the first of the great series of fossil-bearing rocks was laid down.

The rocks of the Cambrian and later successive early geologic ages contain abundant remains of animal life, but they do not so frequently preserve remains of plant life. Yet the very abundance of animal life implies equally or more abundant plant life, for plant life forms the basic food supply of the animal kingdom. Here and there under favorable conditions evidences of plant life are preserved in these earlier rocks, but such evidences usually consist of imprints or fillings of imprints, that is, of molds or casts rather than of remains of the actual plants themselves.

THE MAGNETO-OPTIC METHOD OF ANALYSIS

CRITICISMS of Professor Fred Allison, of Alabama Polytechnic Institute, on the reliability of experiments by which he claims to have discovered the missing element number 87, have been met by investigators at Emory University.

Professor J. L. McGhee and Margaret Lawrenz, using an improved model of Professor Allison's magneto-optic

apparatus, confirmed his findings, they have reported to the American Chemical Society. Professor McGhee and Miss Lawrenz also say that they failed to get results to support the statement of Professor Jacob Papish, of Cornell University, the rival discoverer of the new element, that Professor Allison's results were due to traces of the known elements, tin and rhenium.

Professor McGhee began tests of the still widely doubted magneto-optic method by giving Professor Allison a number of mixtures of substances whose composition he knew, but which were "unknown" to Professor Allison. Analysis of their composition made by Professor Allison with his new magneto-optic method proved to be entirely correct, according to this report. Additional comparisons of results of the Georgia and Alabama instruments are also said to have shown substantial agreement.

In examining Professor Papish's attacks, Professor McGhee prepared solutions of pollucite, lepidolite, samarskite and caesium chloride, in all of which Professor Allison claims to have found element 87. The magneto-optic analysis of these solutions was then compared with that of tin chloride and rhenium chloride, the substances Professor Papish said might have been responsible for Professor Allison's findings.

Though certain "minima" were found in common, the six special "minima" of element 87 were not found in the tin and rhenium chloride solutions. The Georgia investigators believe that this test invalidates Professor Papish's criticism.

OAK FORESTS OF EUROPE

WHAT is possibly the oldest oak forest in Europe, containing specimens believed to be over eight centuries old, has its very existence menaced by a crowding host of upstart birch saplings. The soil is favorable for them and they grow apace—and not a single young oak tree is in sight to replace the giants when they fall.

This bit of menaced woodland stands in Oldenburg, in North Germany. It is only about 120 acres in extent, and is unique among western European woodlands in that the ground has been continuously in forest since at least the Middle Ages. It probably has never been anything else. Due to the medieval practice of feeding swine in the woods, the stand was for hundreds of years kept fairly open, and trees developed trunks twenty feet in circumference, with vast spreading crowns. Ferns and holly bushes, some of the latter reaching small tree size, flourished in their shelter.

The only other known area of virgin timber in western Europe is in Czecho-Slovakia, on the Bavarian-Bohemian frontier mountain range. Originally the property of Prince Schwarzenberg, it is now held and protected by the Czecho-Slovakian Government. It once had an area of about 3,300 acres, but in 1891 was reduced to a mere fragment of some 110 acres. Unlike the Oldenburg forest, this mountain woodland is principally in ever-

greens—firs and spruces—together with beech. Some of the trees are of extraordinary height for their species, their tops reaching up 150 feet or more. Since the policy of "let nature alone" has been followed here, much of the wood is choked with the trunks of great trees that have been blown down by the wind.

These two bits of woodland serve to give North Europeans some idea of the kind of world their ancestors lived in.

TERNS OF THE TORTUGAS

BIRDS with an extraordinary "homing sense" are the common terns, or sea swallows, which have been the subject of extensive study by the Carnegie Institution's Marine Biological Laboratory on Bird Key, one of the Tortugas Islands in the Gulf of Mexico, where a great colony of the birds migrate each summer for the nesting season.

Experiments conducted some years ago by Dr. John B. Watson, formerly of the staff of Johns Hopkins University, who cooperated with the institution to investigate the terns of the Tortugas, show that these birds can, without any training whatsoever, reach home from distances of at least a thousand miles even though the territory over which they fly is completely barren of any marks which might guide them. Terns were released by Dr. Watson at Key West, Florida, Cape Hatteras, North Carolina, and Galveston, Texas. The majority of them returned to their nests at Bird Key in the Tortugas. From Cape Hatteras to Bird Key by the alongshore route is 1,081 miles.

The world's long distance record for homing pigeons is, in comparison, only 1,010 miles, and was made by a bird selected and trained for the purpose. Terns, however, are entirely untrained and fly to suit their own fancies and without any idea of breaking "homing records." They make their way back to the nesting ground in spite of darkness, storm and unknown seas, Dr. Watson found. Just how to explain this marvelous ability of the terns of the Tortugas is to date beyond reach. The strange power remains a baffling mystery.

Not only are the terns adept at homing, but they never fail to identify their own eggs and chicks. This would appear an impossible task as the terns cover the sandy Bird Key with thousands upon thousands of similar-looking eggs. Yet when one tern comes back from patrolling the shoals about the island in search of minnows to feed the young, he always locates the right spot and picks out his own eggs and babies from the countless ones that surround them.

The habit of catching minnows to feed the young terns has proved a boon to science. From the partially digested bits of food dropped by the adult terns, it is possible to classify various types of fishes. Through this method, Dr. W. H. Longley, who is in charge of the Marine Laboratory, has identified ten species hitherto unknown at Tortugas and two others little known anywhere. He has also learned that the terns catch fish which had been supposed to be of nocturnal habits, as well as others believed to live only on sea bottom in deep water.

THE LOCOMOTION OF SNAKES

SNAKES do not travel at high speed, popular opinion to the contrary notwithstanding, according to Dr. Walter Mosauer, zoologist at the University of California at Los Angeles.

Under repeated tests the famed blue-racer snake never exceeded a maximum speed of two and one half miles per hour. Reports of racing speed are usually the result of mental delusion promoted by fright, both of the observer and the snake, and by the winding motion of the creature.

The method by which a snake propels himself is revealed in a critical investigation described by Dr. Mosauer. An ingeniously planned research, in which the x-ray camera, scalpel and stop-watch were featured, included everything from African vipers to boa constrictors. From the report it is evident that the serpent's inside power plant is much more complicated than his externals.

Devoid of legs, fins or other reasonable propeller mechanism, the snake makes up for these shortages with an elaborate muscular layout. In general his backbone is connected with his ribs by a host of strap muscles, each tied to at least one vertebra and one rib.

Sometimes a rib is connected to a joint sixteen ribs away, sometimes to one near-by. These connections permit any kind of wiggle or bend in any direction. Nothing is connected at right angles, all forces acting obliquely. Accordingly, Mr. Serpent never gets on "dead center" and seldom feels mechanically awkward.

The well-known but mystifying locomotion of the "side-winder" rattlesnake was studied by Dr. Mosauer. The venomous creature apparently prefers to slide sideways in two parallel tracks over the desert sand. In this performance he corresponds to a two-loop spiral, modified slightly by muscular displacement. Naturally the two loops make parallel tracks. At regular intervals the spiral leaves one track, and a new track is started one space in advance.

CANNIBAL REMAINS ON ALASKAN ISLAND

HUNDREDS of human bones plainly cracked open for marrow have been discovered on Kodiak Island, off the coast of Alaska, by Dr. Aleš Hrdlička, of the U. S. National Museum. This evidence, Dr. Hrdlička reports, gives unmistakable proof that prehistoric inhabitants of Alaska were cannibals.

The discovery marks the first time that traces of cannibalistic practice in the Far North have been unearthed. Just what it means on Kodiak Island, Dr. Hrdlička will not know until he has investigated further.

Cannibalism is known to have been practiced by some tribes in North America and in Africa and Australia. Human flesh is still eaten to-day by the Battas of Sumatra, in other oceanic islands, Australia, South America and parts of Africa.

Dr. Hrdlička found the bones last summer while he was excavating on the island, but chose not to reveal the information until the island was fully protected from curious seekers. It is now protected by the government.

Arm and leg bones, cracked open for marrow, were found scattered widely through layers of old house ref-

use. They were not charred, probably having been eaten raw or cooked in water. Their prevalence throughout numerous layers indicates that the practice of eating human flesh was kept up over a long period of years.

To what tribe the victims belonged is not known, but not far distant from the site is evidence of persons of the same type who lived without cannibalism.

THE MATTO GROSSO EXPEDITION TO SOUTHERN BRAZIL

ADVENTURES with jungle Indians in Brazil who greeted an airplane bravely with a shower of long arrows and who regarded the fliers as strange and mysterious beings are among the highlights of the Matto Grosso Expedition, which has returned from its year of researches in this wild region of southern Brazil.

"For these Indians to try to bring down an airplane with arrows was an exhibition of the highest bravery," said Vincent M. Petrullo, anthropologist of the expedition, who is conferring with anthropologists at the U. S. National Museum.

"We dropped a sack of presents from the plane," he added. "It landed on a roof and one of the men climbed up to get it. The village people gathered and had a huge feast, and for weeks they looked to the south and called the strange bird to come back."

The expedition found that these things happened after the plane flew over, because the explorers followed up their air survey of the unmapped country by going up the rivers in canoes to visit villages 350 miles from civilization by airline. They found the Indians who shot at them to be a very primitive tribe. They did not even have dogs for companions, as Indian tribes often do.

To talk to this tribe, the Yawalapiti, it was necessary to relay the speech through four interpreters. One of the Bakairi Indians, who traveled with the exploring party and who understood a little Portuguese, would take the question from Mr. Petrullo. The question would be translated into the Anahuaqua language and relayed to a Mihinaku, who, in turn, spoke at last to the person really addressed.

At the village where the airplane battle occurred, some of the Indian men had seen white men before. They had encountered a party looking for the explorer, Colonel P. H. Fawcett, who was lost in 1925 and has been sought since by a number of explorers. Mr. Petrullo talked with the natives who ferried Colonel Fawcett across the last river, where the record of the explorer mysteriously ends. The natives say that Colonel Fawcett was sick. His son and companions wanted to turn back, but the Colonel insisted on pushing ahead to the next river where, the Indians say, he expected to get "big canoes" and travel would be easier. Before reaching the river, however, he would have to cross a stretch of high grass. Sickness, thirst or starvation appear to have overcome the daring party.

The Matto Grosso expedition, which was directed by E. R. Fenimore Johnson, has had better fortune. It has returned with many tales of adventure and a quantity of scientific data on the people, animals and plant life of a region that is famous because it is so little known.

The worst catastrophe the expedition has to report is the loss of three out of seven bark canoes. The canoes went down into a tributary of the Xingo River, carrying many photographs and notebooks filled with data. This happened on the field trip to the Yawalapiti. The explorers succeeded in bringing back sound and motion picture films of a number of eastern Bororo tribes. The Indians, shy at first of the microphone, the camera and the strangers, overcame microphone fright very successfully, and performed their songs, dances and demonstrated their rattle music for the records of science.

ITEMS

BECAUSE it can almost see invisible moisture in the atmosphere, the electric eye, or photoelectric tube, has been made robot operator of a humidifier which conditions air for human breathing. This unique application of the photoelectric tube is found in newly developed home humidifying apparatus. A window pane, playing the first-aid part of spectacles, enables the electric eye to detect moisture, because the amount of water that accumulates on a window can be taken as a good measure of moisture in the air. The apparatus directs a beam of light through the window on a photoelectric tube. When moisture is on the glass, the light is weakened and the tube responds to turn the humidifier off. When the moisture evaporates, the beam is strengthened and the tube responds to turn the humidifier on.

FREEZING fruits and vegetables to preserve them without first sterilizing them by heat does not kill the botulinus germ if it was present in the food originally, was reported by Dr. Lawrence H. James, of the U. S. Bureau of Chemistry and Soils, to the Society of American Bacteriologists meeting in Baltimore. However, there is no danger of botulinus poisoning if the frozen food is defrosted, cooked and used immediately when received from the store. Dr. James subjected the spores of the botulinus bacillus to the same degree of freezing that is used in commercial cold storage methods. He found that the number of these spores, from which new botulinus germs could develop, was not reduced at all by the cold temperatures, regardless of the length of time the temperatures were maintained. On the other hand, no poison had developed from the spores during the freezing.

APPLES come through cold storage safely without harm to their vitamin C. Frozen apples have been kept for four months without losing an appreciable amount of this vitamin. This important fact has been ascertained by Dr. S. S. Zilva and Miss M. F. Bracewell at the Lister Institute, London, and Dr. Franklin Kidd and Dr. Cyril West at the Low Temperature Station, Cambridge. The apples used were Bramley's Seedlings. It was found that they could be stored in air at 3 degrees centigrade for five months and yet contain as much vitamin C as they did originally. Experiments on the distribution of vitamin C in various parts of the apple gave remarkable results. The vitamin is not by any means evenly distributed through the fruit. There is far more vitamin C near the skin than in the center, and the peel contains six times more vitamin than the flesh near the core.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE VELOCITIES OF NEBULAE

A DISTANT portion of the universe is apparently rushing away at a speed greater than that previously observed by astronomers.

In a communication to the executive offices of the Carnegie Institution of Washington, Dr. Walter S. Adams, director of the Mount Wilson Observatory at Pasadena, reports the discovery in two nebulae of apparent movement away from the earth at the rate of 15,000 miles per second. The highest velocities thus far indicated by observation have been of the order of 12,500 miles per second.

The two objects which seem to be rushing away from the earth with the speed of an explosion are very faint nebulae in a cluster discovered by Dr. Edwin P. Hubble in the constellation of Gemini. Estimate of their apparent speed is based upon an observation made by Mr. Milton L. Humason. They have been determined to be 135,000,000 light years distant from the earth, a very great distance but not quite as far as the frontier of observable space. Light travels at the rate of 186,000 miles per second.

This discovery is expected to be of special concern to Dr. Albert Einstein and Dr. Willem de Sitter, the Dutch astronomer, who are now in Pasadena, because of their interest in research concerning the possible expansion of the universe. It also extends our knowledge of the relation between distance and apparent rate of recession or movement away from us of distant nebulae as described by Dr. Hubble.

The fact that our Milky Way galaxy is apparently the center from which other groups of stars or nebulae are rushing at speeds of thousands of miles per second has been the matter of first importance to astronomers since it was discovered at the Mount Wilson Observatory. Evidence of the phenomenon was given by the huge 100-inch telescope there, the largest in the world, as a shift toward the red of lines in spectra of the nebulae. The more the lines are removed from their normal positions, the faster the nebulae are traveling away from the earth.

It has been suggested, however, that the nebulae may not be receding as fast as they seem and that a revision of the present accepted theories may be necessary. To verify this evidence and determine whether the universe is actually expanding is a major problem of astronomers to-day.

METEORIC DUST

FRAGMENTS of falling stars drift gently down through the earth's atmosphere, Dr. Maud W. Makemson, professor of astronomy at Rollins College, Florida, has concluded after a series of experiments during the November meteor showers.

The experiments consisted in catching the tiny globules or meteoric dust particles in large pans, placed on a high diving tower in Lake Virginia, on the Rollins campus. The fragments were easily distinguishable

from ordinary dust and soot by their shape, color and formation. Except when shattered by impact with the receptacle, or in handling, they are usually round or of regular form. In substance they resemble volcanic glass or obsidian, while in color they range from clear glass to amber, or through amethyst to smoky gray.

An interesting feature of the glass globules is that they are electrified or magnetic, which might be expected from the fact that they pass through an electrified stratum of air far above the earth.

It is a well-known fact that while thousands of meteors enter or traverse the earth's atmosphere daily, very few meteorites ever fall intact to the surface of the globe. The fall of meteors is always accompanied by a brilliant light and usually followed by an explosion of the heated gases when the collision with the ground occurs. Consequently the fall on inhabited regions of the globe can hardly pass unrecorded.

From the thousands of meteors which explode in the air or are completely consumed by the intense heat generated in their swift motion, the tiny glass globules are formed as the result of rapid cooling in the frigid upper air. The colors are due to the various mixtures of minerals of which the original meteor was composed.

Dr. Willard J. Fisher, of the Harvard College Observatory, whose collection of cosmic dust has extended over a period of thirty years, has practically eliminated all alternatives for explaining their origin as terrestrial, having examined dust from furnace flues, locomotive smoke stacks and other sources. In Dublin, Ireland, Hartley and Ramage collected dust from the showers of Leonids in November, 1897. In France, Lucien Rudaux is at present investigating along this line.

Dr. Makemson believes that conditions in Florida are almost ideal for the collecting of meteoric particles, owing to the level, well vegetated surface, the falling currents of air, and the absence of factories and industry. She has transferred her experiments to Lake Conway, at a distance of several miles from any town in order to eliminate smoke particles and terrestrial dust as far as possible. Her plan is to continue the collecting over a period of six months, keeping the result of each week separately, and to compare the fall of dust with the observations of meteors, as reported by members of the American Meteor Society. She believes that if a correlation between the amount of dust and the number of meteors can be found, this fact will be an additional proof of the cosmic origin of the tiny globules.

THE EFFECT OF DIET AND ENVIRONMENT ON DISEASE GERMS

THE importance of feeding disease germs the right diet and providing them with suitable environment in order to persuade them to grow in the laboratory, where they can be studied and means of combatting them found, was emphasized by Dr. Arthur Isaac Kendall, professor of research bacteriology at Northwestern University Medical School, who delivered the De Lamar lec-

ture at the Johns Hopkins University School of Hygiene and Public Health on January 12.

Dr. Kendall last year reported a method of making germs undergo a transformation, rendering visible germs invisible and large germs, that would not pass through porcelain filter pores, so small that they passed through the finest of these filters. He achieved this by providing the germs with a new type of culture medium, which is the substance on which germs grow in the laboratory. He calls his new medium the K medium, and in his lecture he emphasized the fact that it is still in a crude state and too much should not be expected from it in the way of isolating the germs of influenza and the common cold, for instance.

Dr. Kendall called attention to the fact that the environment of the digestive tract, such as his studies show, would encourage the existence of non-filterable germs, while the environment of the respiratory tract corresponds to the type of medium or environment which he found encouraged the growth of filterable germs.

"In the light of this rather striking difference between the two tracts," Dr. Kendall commented, "it is not without significance that many, if indeed not most, of the contagious so-called filterable viruses according to current information appear to enter and to leave the body through the respiratory rather than the intestinal path."

Influenza, for example, is considered to be due to a filterable virus, meaning a germ so small that it can not be seen with the most powerful microscope and that it can pass through the finest-pored filters. The infantile paralysis germ, another filterable virus, is now thought to get into the body by way of nose and throat, like influenza and common colds. The typhoid fever germ, on the other hand, attacks the digestive tract and is a germ large enough to be seen under the microscope, and too large to pass through filters.

Dr. Kendall has, however, succeeded in producing a filterable, invisible form of the typhoid germ. In the De Lamar lecture he described the procedure by which he did this.

TREATMENT OF ANEMIA BY INJECTION

INFREQUENT "shots" of a potent liver extract into the veins of sufferers from pernicious anemia constitute the newest treatment of this disease developed at the Henry Simpson Memorial for Medical Research of the University of Michigan.

Six years ago when liver began the conquest of this once fatal disease the patient had to eat half a pound of liver a day. Then a more palatable extract was made. Later even more concentrated preparations were devised.

Now Dr. Raphael Isaacs, Dr. Cyrus Sturgis and their associates at the Simpson Institute have succeeded in producing a liver extract, about thirty times as powerful as any previously developed ones, and suitable for administration by intravenous injection instead of having to be taken by mouth. The new extract has been used successfully for some months and will be available to all physicians in a short time. Only four to six injections are necessary to restore the blood of an anemia sufferer

to normal, after which health may be maintained by injections given by a physician at intervals of from four to six weeks. No treatment is necessary in the meantime.

The history of the clinical conquest of this once-dreaded disease begins in 1926 when Dr. George R. Minot and Dr. William P. Murphy, of Harvard University, reported the successful treatment of patients with a diet containing large amounts of liver. Eating from one quarter to one half a pound of liver every day for the remainder of their indefinitely prolonged lives soon became an ordeal for the many to whom liver was distasteful. Extracts of liver and of dried hog's stomach were developed and found successful, but these also had to be taken every day by mouth, though the actual quantity was much smaller. The liver extract was unfortunately quite expensive, and even calf's liver, formerly relegated to the cat's plate, soared to unprecedented high prices. So the new extract will be hailed with joy by many liver-eaters.

Before liver was actually used to treat human sufferers from the disease, Dr. George H. Whipple, of the University of Rochester, had discovered, from observations on dogs, that liver was a powerful stimulator of the red blood cells that are lacking in pernicious anemia. The next step was Dr. Minot's perfection of the treatment for clinical use.

Other chapters in the history of pernicious anemia conquest are the development of the liver extract to be taken by mouth by Dr. E. J. Cohn, of Harvard Medical School; the development of the hog's stomach extract by Drs. Isaacs and Sturgis and Dr. Elwood A. Sharp, of the Department of Experimental Medicine of Parke, Davis and Co.; the discovery by Drs. William B. Castle, Wilmot C. Townsend and Clark W. Heath, of the Thorndike Memorial Laboratory, Boston City Hospital, that beef muscle acted upon by normal human stomach juice forms a substance that promptly alleviates pernicious anemia and that the normal human stomach secretes a hitherto unknown substance that prevents the development of pernicious anemia, and, finally, the isolation from liver, by Drs. R. West and H. D. Dakin and Marion Howe, of Columbia University College of Physicians and Surgeons, of a crystalline salt which is active in pernicious anemia.

WATER IN THE HUMAN BODY

THE living human body is full of ice, Dr. Neda Marinnesco, of the Paris Institute of Physico-Chemical Biology of the Rothschild Foundation has announced in a lecture given at Brussels under the Institute of Higher Studies.

Science is not content to have only one kind of ice like your refrigerator. Six different varieties have been discovered by Professor P. W. Bridgman, of Harvard University, in the course of his high pressure researches. Variety number six, which Dr. Marinnesco has found in the human body, exists at ordinary temperatures, between 40 and 176 degree Fahrenheit, only under enormous pressures of over a hundred thousand pounds per square inch.

Dr. Marinnesco states that in living tissues this enormous pressure exists because of the great attraction of

the body colloids or jellies for water. This attraction compresses the water and changes it to solid "ice number six." That is why it is almost impossible to squeeze a drop of water from a living muscle, though it contains a large proportion of the liquid. When the organism dies, its attraction for water diminishes and the "ice number six" becomes again liquid.

Dr. Marinesco used an original method for determining the attraction for water of the various body colloids, including chiefly proteins, etc. He measured the "dielectric constant" of their solutions by means of high frequency radio waves. This tells whether the molecules of a "polar" substance, such as water, are free to turn around, or whether they are "hooked" to neighboring molecules.

For instance, liquid water has a dielectric constant of eighty units, but when it freezes to ice its dielectric constant drops to two units. Most of the water in the human body has also a dielectric constant of only two units, hence it is akin to ice.

HAWAIIAN RACIAL PROBLEMS

RACIAL problems in Hawaii have caught the world's eye suddenly, but scientists have been watching Hawaii for some time, aware that in this small area in mid-ocean a unique development in racial evolution is going forward.

Hawaii is a laboratory where nature is making a big experiment in race-crossing. Members of the chief racial groups of the world have gathered on these cross-roads islands in the Pacific. Class distinctions have remained about as rigid as in other places. But race distinctions have become blurred and have lost their appearance of importance. At schools, social gatherings, at work, there have been contacts between Europeans, Orientals and the brown Hawaiians. No laws prevent inter-racial marriages in Hawaii. So, everything is in favor of a complex blending of racial stocks. Racial or national lines are crossed in about one marriage in four.

What the Hawaiian Islanders are coming to represent, in the way of a racial type, is of great interest to geneticists. It is still the prevailing view in scientific circles that wide race mixtures are bad. Descendants have a tendency to preserve weaker traits rather than the finer traits of both parents. But some of the combinations developed on the Hawaiian Islands are recognized as improved racial types.

The blend of Chinese and Hawaiian in the Hawaiian Islands has produced a stock which stands first among all hybrids in industry and self-support, is the view that has been expressed by Dr. Chas. B. Davenport, of the Carnegie Institution of Washington. In these island half-breeds the intelligence of the Chinese has combined with the well-stabilized, patient temperament of the Hawaiian.

Children born of Chinese fathers and Hawaiian mothers grow to be intermediate in size, taller than the short Oriental, shorter than the tall Hawaiian. This was the finding of Dr. A. M. Tozzer, of Harvard, who has taken scientific measurements of Hawaiian Island inhabitants. The head-shape of first generation Chinese-Hawaiians was found to be like the Hawaiians, but the

face and nose resembled their Chinese ancestors. Some of the first generation hybrids had curly hair, some straight.

Results of some of the other racial blends are not yet so clearly understood. Japanese make up almost forty per cent. of the Island population. Europeans and Americans are not so numerous, but in Dr. Tozzer's investigation he found that these nationalities mated with Hawaiians with a frequency out of proportion to their numbers on the Islands. Of the hybrids he measured, 57 per cent. were part European.

Another Harvard expedition, under the direction of Dr. H. L. Shapiro, initiated a new study of the Hawaiian Island people about a year ago. This investigation has as its aim to learn how racial mixtures affect bodily size and energy and other matters of inheritance. Several years' work were projected.

ITEMS

No indication of an epidemic of influenza appears in the reports of state health officers to the U. S. Public Health Service. For the week ending January 9, the latest for which reports are available, there were 1,227 cases of influenza reported throughout the country. This is an increase of 119 over the previous week's total, which is not considered significant, especially as this is the time of year when a slight increase in influenza and all respiratory diseases normally occurs. The U. S. Public Health Service has not been officially notified of any influenza epidemic in England, although unofficial reports of one have come to this country.

TEN cases of parrot fever with one death in California have been reported to the U. S. Public Health Service. The fatal case was that of Walter R. Kaestner, the U. S. customs inspector at San Pedro, port of Los Angeles, who died on January 11. A wire report from the city health officer of Los Angeles states that the customs inspector in the course of his duties handled three shipments of birds during December. Since the outbreak of parrot fever in this country in 1930, parrots shipped into this country must be held in quarantine by the customs officials for a period of observation, to determine whether or not they are suffering from the disease. The San Pedro inspector is reported to have taken two parakeets and two rice birds home to his wife.

DR. VEADER LEONARD, of the School of Hygiene and Public Health of the Johns Hopkins University, writes: "The following note appears on page 9 of the issue of SCIENCE for January 1, under Science News: 'A safe and apparently certain treatment for hookworm was found in the synthetic antiseptic, hexylresorcinol, by Dr. Veader Leonard, of the Johns Hopkins University.' While I am responsible for having introduced hexylresorcinol into medicine some years ago, the anthelmintic properties of this drug were discovered and its clinical application as an anthelmintic was first developed exclusively by Dr. Paul D. Lamson, professor of pharmacology at Vanderbilt University, and his associates, Drs. B. H. Robbins, H. W. Brown, C. B. Ward and R. L. Caldwell."

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The fourth annual meeting of the Committee on the Effects of Radiation upon Living Organisms of the Division of Biology and Agriculture of the National Research Council will be held the first week of May. At this meeting requests for grants of money and for apparatus to be used during the year beginning July 1, 1932, will receive consideration. Application blanks, which will be mailed on request, should be duly executed and must reach Washington not later than March 15th.

All correspondence should be directed to the Division of Biology and Agriculture, National Research Council, 2101 Constitution Avenue, Washington, D. C.

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SCIENCE NEWS

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RESEARCH IN COSMIC RAYS

BALLOONS bearing automatic recording instruments, floating free to heights hitherto unattained in such studies, are planned for the further investigation of cosmic radiation by Dr. Robert Andrews Millikan, of the California Institute of Technology. The launching place for these unmanned explorers of the upper air has not been announced, except that it will be in a different latitude from that used for similar experiments in 1922, when Dr. Millikan and his colleague, Dr. I. S. Bowen, sent up recording balloons from Kelly Field, Texas.

In these tests ten years ago, one of the balloons reached a height of 15.5 kilometers, or 9.6 miles. Dr. Millikan hopes to send this year's balloons to greater heights, carrying their feather-weight equipment of recording electroscopes, barographs and thermometers into regions where the blanket of air is far less dense and correspondingly more penetrable to the cosmic rays.

Investigations at great heights, as well as under great depths of water, have been considered of much importance in the study of cosmic radiation. With other rays, there is a difference in their penetrating power, depending on their wave-length: the shorter the wave-length, the "harder" and more penetrating the radiation. The same rule may be presumed to hold for cosmic rays. Dr. Millikan has stated as a result of his earlier studies that he has been able to distinguish a cosmic-ray "spectrum" of several wave-lengths. Possibly the higher ascensions planned for this year will carry his instruments out into a region where they can pick up "softer" rays of greater wave-length, that are stopped by the deep atmospheric blanket that surrounds the earth.

A PHOTOELECTRIC RECORDER

A NEW and extremely sensitive recorder that uses light and electricity to measure smoke, heat, light, pressure, noise and thicknesses of thin materials was introduced to the American Institute of Electrical Engineers meeting in New York, on January 25, by its inventor, Mr. C. W. LaPierre, of the General Electric Company.

Less than a hundred millionth of the electricity used by an ordinary 40-watt electric light will set the new photoelectric recorder in full operation. Errors of a millionth of an inch are detected when this new engineering tool is used to measure dimensions.

Anything that can be indicated by a sensitive instrument can now be continuously recorded by the photoelectric recorder, Mr. LaPierre explained. It is rapid in its response as well as sensitive. An optical system, using a galvanometer mirror, is combined with a photoelectric circuit in the new instrument.

As a 24-hour watchman on the alternating frequencies of electric current supplies, the new recorder promises to keep tab on the very small variations that may cause electric clocks in households to lose or gain small fractions of a second. Variations undetectable to the ordinary users of these clocks will show up as deviations

of an inch or more in the photographic records of the new instruments.

By combining a photoelectric cell smoke detector with the new recorder, the amount of smoke in the stack of a furnace has been charted continuously and automatically. A photoelectric cell or electric eye is also used in the recording device itself.

TUBERCLE BACILLI IN THE BLOOD

A NEW method by which the presence of tuberculosis germs can be detected in the circulating blood of patients suffering from tuberculosis has been found. The method, developed by Professor Ernest Loewenstein, of Vienna, was described by Dr. Laszlo Detre, of the University of Budapest, Hungary, in a report to the District of Columbia Medical Society.

By this method, Dr. Detre said, the presence of the germ can be detected in very early stages of pulmonary tuberculosis, which is important from the standpoint of successful treatment; in cases of surgical tuberculosis in which there is no fever; and in different forms of tuberculosis of the skin.

Dr. Detre stated "that it has proved, contrary to older opinions, in an organism attacked by tuberculosis there is a regular circulation of tubercle bacilli in the blood stream."

By means of the new method, it is claimed, certain other diseases have been found to have a tuberculous origin, for instance, acute polyarthritis or acute inflammation of the joints, popularly known as rheumatism. Until now, certain infections of teeth or tonsils have been considered responsible for this disease, Dr. Detre pointed out. But by means of the new test, a tuberculous origin of the disease was found. In most of these arthritic cases it was the bovine form of the tuberculosis germ, that is, the form found in cattle, which played the important rôle. Another disease which the new test is said to show has a tuberculous origin is multiple sclerosis, a nervous disease whose cause is generally considered unknown.

Dr. Detre emphasized the practical consequences of the new findings and advised American bacteriologists to follow this new line of research. New methods of treatment are suggested as a result of this new test, he said. Dr. Loewenstein, who has been working for 15 years on this test, which involved the development of a new synthetic culture medium for the germs to grow on, is receiving samples of blood from cities all over Europe for examination by the new method.

SUBMARINE VALLEYS

A SPRING of fresh water gushing from the sea bottom just off St. Augustine, Florida, and flavoring the air with sulphur, submarine springs of oil off the California coast, a drowned canyon of the Hudson River outside New York harbor—these and other oddities of the ocean that are seen by the men that go down to the sea in the

ships of the U. S. Coast and Geodetic Survey were described to the radio audience of the Columbia broadcasting system on January 22, by Lieutenant-Commander R. R. Lukens in a talk arranged by Science Service.

The drowned canyon of the Hudson, Commander Lukens said, has been accurately surveyed by government investigators. Soundings have found a depth of 2,400 feet and a width of three miles. Although men will never see the grandeur of the scenery this might provide were it lifted above the ocean, this canyon still performs a useful function, for it serves as a sure guide in thick weather to ships provided with echo-sounding devices to aid in their navigation. They can "listen their way" along this deep trough, with as much confidence as they could watch beacon lights if they were visible.

Far on the other side of the world, off the southern Philippines, is a submarine valley compared with which the drowned Hudson gorge is a mere pinscratch. This is Mindanao Deep, where the new cruiser *Emden*, Germany's first post-war fighting ship, in 1927, echo-sounded a deep spot for a record of 35,400 feet, or nearly six and three quarters miles. This "hole in the bottom of the sea" lies within 75 miles of a mountain 6,027 feet high; so that there is a total difference in elevation of over 41,000 feet, which is 12,000 feet greater than the height of Mt. Everest.

ARCHEOLOGICAL WORK IN ALASKA

MAROONED for nine months in the Arctic by his own wish, a young Smithsonian archeologist, Mr. James A. Ford, is spending his time studying Eskimo villagers and taking long automobile trips across the ice. His automobile, said to be the first ever used north of Nome, has been equipped with skis instead of front wheels. The first letter from Mr. Ford, reporting his winter activities, has been received by the Smithsonian Institution.

Mr. Ford is spending nine months at Point Barrow, so that he may start digging at ancient village sites as soon as the ground thaws. By being on the spot he can have three full months for his excavations, June, July and August. Ordinarily, archeologists who go to the Arctic take the first boat which can break through the thawing ice, and return on the last boat of the summer, just in time to escape being icebound. With the most favorable ice conditions, this allows a brief month for scientific digging.

The sites which Mr. Ford will explore next June are four or five large mounds which represent ancient villages. Investigators who are trying to trace the ancient history of the Eskimos have looked with an interested eye on these mounds, because they may contain new evidence of the evolution of Eskimo culture. Point Barrow was a sheltered spot on the Arctic coast, and is believed to have been a pivotal point in migrations of far northern tribes.

Mr. Ford is now studying the customs of the Eskimo people and also taking their hand and foot prints. The prints are being collected for a scientific study of racial differences. Anthropologists making the study at Tulane University believe that there are differences in the hand and foot prints of the various races.

Touring over the Arctic ice by moonlight in an auto sledge is exciting, Mr. Ford writes, but it is not an ideal way of riding. The ice is rough and there is constant danger of upsetting. Still, the automobile on skis offers the fastest means of travel, faster than either boat or dog sledge.

ITEMS

VITAMIN A, the growth-promoting vitamin found in liver, cod-liver oil, butter fat, egg yolk, and green and yellow vegetables, has just been isolated by Professor J. C. Drummond, professor of biochemistry in University College, University of London, in association with Professor I. M. Heilbron and Dr. R. A. Morton, of the University of Liverpool. The report to the Society of Chemical Industry, which will appear in the forthcoming issue of the society's journal, *Chemistry and Industry*, describes how, by splitting carotene into two products, the very elusive vitamin A was obtained. Carotene is the pigment which gives the yellow color to carrots, yellow corn, butter, egg yolk and other yellow-colored members of the plant and animal kingdoms. One of the two products obtained by splitting carotene is vitamin A, they believe. They describe it as an alcohol and state that it contains no nitrogen and has a potency about equal to that of the newly discovered crystals of vitamin D. At the same time these investigators reported that they had obtained from halibut liver oil a sticky, yellowish oil which is nine tenths pure vitamin A.

EVERY time the lightning flashes fertilizer is being added to the earth, according to computations made by Dr. W. J. Humphreys, of the U. S. Weather Bureau. Ozone of the lower atmosphere, ammonia and oxides of nitrogen are produced by the electrical discharge of the thunderbolt in the atmosphere. All of these synthetic chemicals made by lightning react with water in the air. The ammonia dissolves in rain, becomes ammonium hydroxide, and serves as plant food. The nitrogen oxides react with atmospheric water to form nitric and nitrous acids carried to earth to form soluble nitrates and nitrites which are good fertilizers. Over 770 million tons of 100 per cent. nitrogen fertilizers are thus delivered to the soil each year, at the average of 12 pounds per acre a year. It is thus believed that regions where lightning is frequent and heavy may be more fertile because of this free gift of lightning-made nitrogen compounds.

EVOLUTION has been reversed for a stock of guinea-pigs in the laboratories of the University of Chicago. As a result of protracted breeding experiments conducted by Professor Sewall Wright, the animals have recovered five of their six toes, which disappeared somewhere on the long road from the days when guinea-pigs, or their ancestors, had the full typical vertebrate complement of twenty toes apiece. Ordinary guinea-pigs now-a-days have only fourteen toes. Big and little toes are missing from their hind feet, and "thumbs" from their front feet. In Professor Wright's breeding stock each animal now has a total of nineteen toes. Extra toes have been produced in some of the animals during the course of the experiment. One specimen had forty-four digits.

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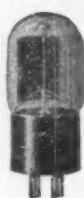
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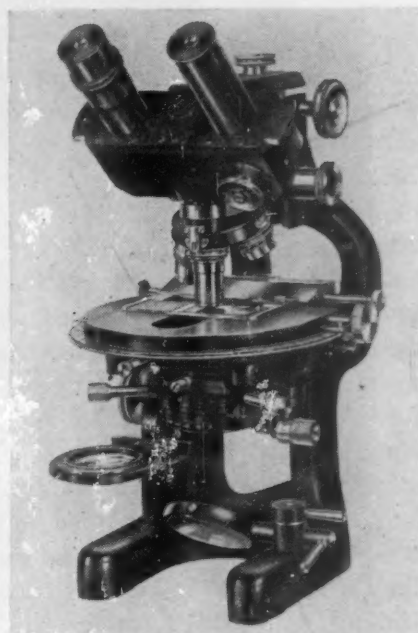
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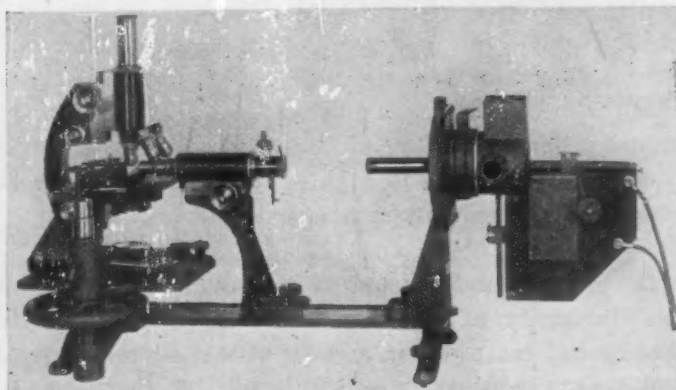
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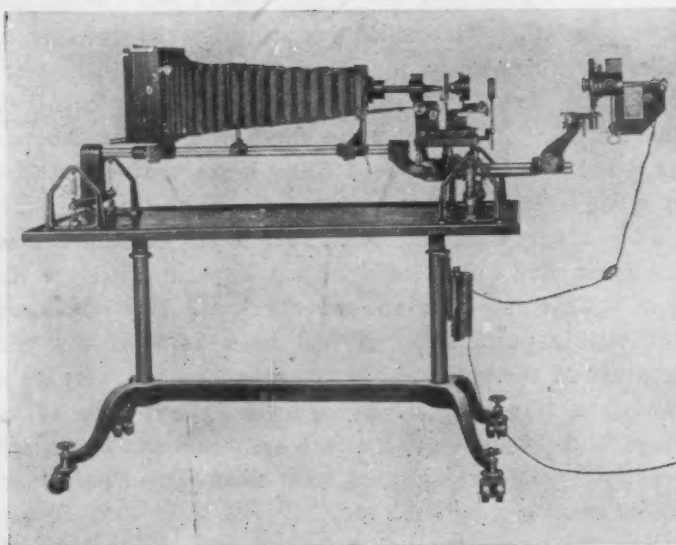
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PAPERS PRESENTED AT THE NEW ORLEANS MEETING

A TROPICAL scourge afflicting descendants of the Maya living in coffee-growing highland regions of Guatemala can now be wiped out through research by Dr. Richard P. Strong, Harvard's eminent investigator of tropical diseases, who described his discovery of the cause and treatment in his lecture at the opening meeting. Dr. Strong believes that a medical expedition could completely conquer this disease before it spreads to other parts of the tropics of the Americas. More than half the Indians in some of the villages have unsightly tumors on their heads, caused by a worm, called scientifically *Filaria onchocerca*. After proving that the worms cause these abnormal growths, Dr. Strong searched for the manner in which the natives are infected. Knowing that most of the worm infections that plague other warm parts of the world are carried in one stage by insects, he considered the common biting insects of the regions as suspects. A single kind of fly, known as the coffee fly and related to the turkey gnat of southern United States, was found guilty. It breeds only in the swiftly flowing streams that are the only water supply of the region. When coffee flies bite a sufferer from the disease they are infected with one stage of the worm, which then develops in the fly and is passed on to a well person bitten by the fly. The way the disease is carried from insect to man and man to insect is much like the history of the parasite causing malaria.

DR. FREDERICK EBERSON, of Mount Zion Hospital and the University of California Medical School, reported that he had succeeded in making visible microbes appear and grow where only a carefully filtered fluid from the brain and spinal cord of infantile paralysis victims had been planted. The cause of infantile paralysis is attributed to a microbe too small to be seen with a microscope and capable of passing through the pores of the finest filter. A special germ food used by Dr. Ebersson consisted chiefly of minced sheep-brain tissue contained in a veal broth. Into a test-tube of this material he placed a very small amount of filtered substance from the brain and spinal cord of monkeys ill with the disease. This test-tube culture developed the very small but visible germ after it had been kept at the temperature of the human body for several weeks. By transferring a tiny drop of the growth in one tube to another, he kept the disease strain alive and saw it multiply greatly. The crucial test was when Dr. Ebersson infected monkeys with the visible germs, saw them develop poliomyelitis in typical severity and then grew the visible germs from the invisible organisms in the fluids of their diseased nervous system.

DR. CARL CASKEY SPEIDEL, of the University of Virginia, who received the \$1,000 prize of the American Association for a suitable paper presented at New

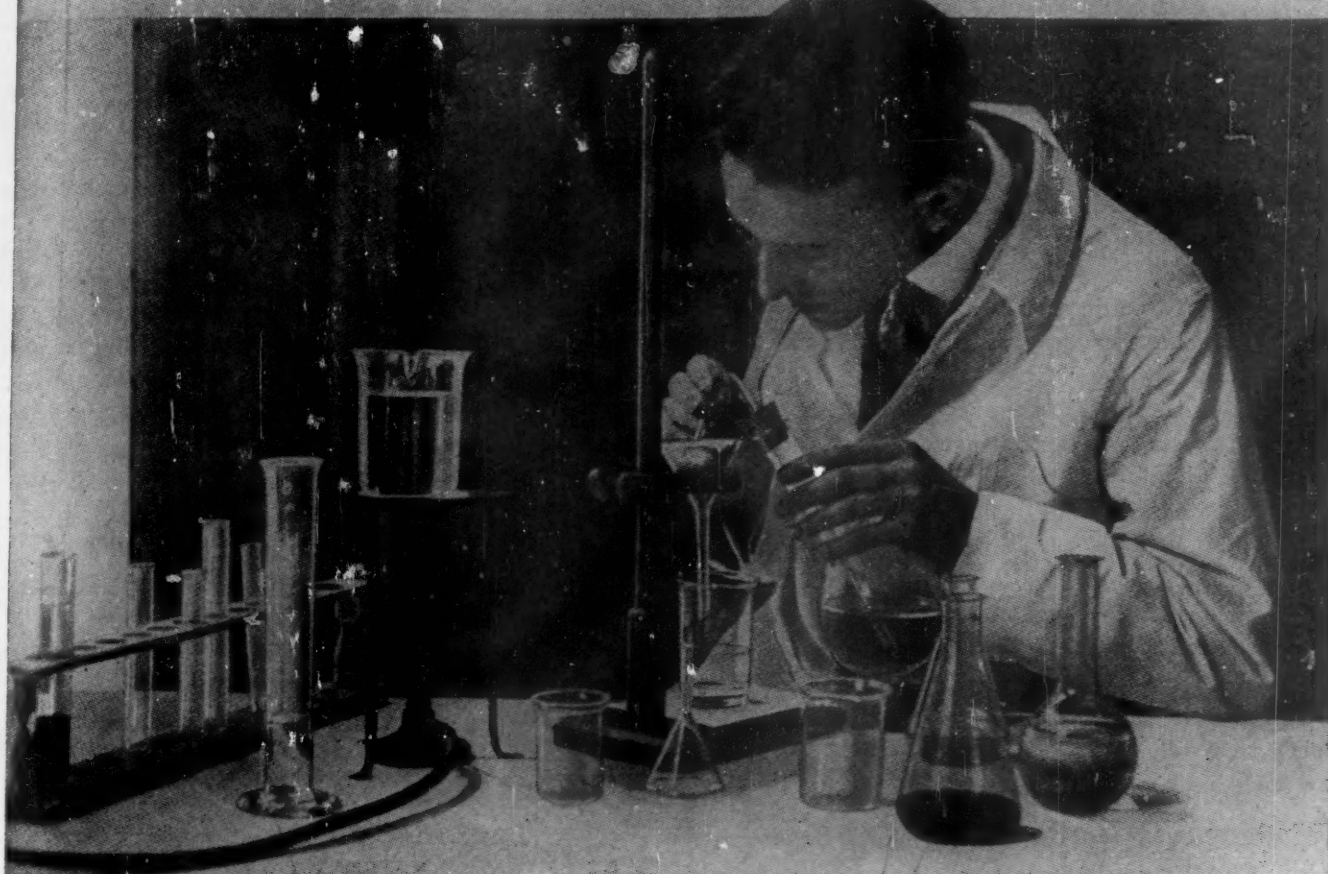
Orleans, reported that living, growing nerves of the tadpole sprout from the spinal cord and, like a telephone wire being strung from a central office to a home, to go directly to the muscle or sense organ they were destined to connect with the central nervous system. With his microscopic observations which revealed the growth of nerves in the living body for the first time, Dr. Speidel settled conclusively a controversy in neurology that has raged since 1860 when the German biologist, Wilhelm His, suggested that nerves grow outward just as Dr. Speidel finds they actually do. The opposing theory was that nerves grew by the connecting up of cells already existing in the region between the central nervous system and the part of the body to be controlled by the nerve.

SUCCESSFUL immunization of an animal against a many-celled parasite has now been accomplished, and this may be the first step toward the development of a preventive of tapeworm and other parasitic infections in human beings. Professor Harry M. Miller, Jr., of Washington University, reported that by injecting portions of a tapeworm into rats it is possible to prevent the development of tapeworms from eggs fed later to the rats so protected. The worm thus baffled by this immunizing injection lives in the intestine of the cat and has its larval stage in the liver of the rat. Although it has been possible to immunize and protect animals from disease caused by typhoid and many other one-celled bacteria, more complex invaders have not hitherto been stemmed by any attempts at immunization. Professor Miller's research is therefore hailed as encouraging.

THE extract of the adrenal cortex glands may be a hormone necessary for the proper functioning of all the tissues of the body, according to Professor Frank A. Hartman, of the University of Buffalo. This extract, called cortin by Professor Hartman, has been used in the past to rescue from the brink of the grave sufferers from Addison's disease. Now Professor Hartman has evidence that cortin is resistant to disease toxins and necessary to normal growth, kidney functions and other bodily mechanisms.

EVIDENCE of a new hormone in the body which regulates cell activity and which might be able to check the growth of cancers when given in concentrated form was reported by Drs. Donald C. A. Butts, Thomas E. Huff and Erwin C. Manz, of the Emery Laboratory, Hahnemann Hospital and Medical College, Philadelphia. The possible hormone is secreted by the spleen, blood-forming organ of the body, and is either itself a sodium compound or is capable of governing the body's use of sodium. Normally this secretion or hormone is dissipated about the body by means of the circulating blood from which the tissues of the body absorb and store it.

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THAT a vitamin has been manufactured in the laboratory by strictly chemical methods for the first time, Drs. Charles E. Bills and Francis G. McDonald, of the Mead, Johnson and Co. Research Laboratories, Evansville, Indiana, reported. They synthesized vitamin D, the so-called sunshine vitamin, by treating ergosterol with nitrogen monoxide gas and obtained the potent vitamin without the use of ultra-violet radiation. At present vitamin D is made by shining ultra-violet light on ergosterol, whereas before the relationship between vitamin D and sunshine was discovered five years ago, children had to take cod-liver oil to obtain vitamin D that prevents rickets. The synthesis of the vitamin is carried out in solution with methyl alcohol, ether and ethyl acetate at low temperature and with rigid exclusion of oxygen. An extremely pure non-crystalline preparation of vitamin D was described by Drs. Bills and McDonald. In company with four European laboratories, they have also produced crystalline vitamin D. The purest of these substances is claimed to be the most potent drug known.

JUST what happens within the brains of persons mentally ill, anesthetized or drugged, promises to be discovered in the near future through experiments on human beings in which blood is extracted safely from the artery leading to the brain and from the vein carrying blood away. The new method of chemical and physical investigations of brain activity was described by Dr. Abraham Myerson, of Boston. Through a careful operational technique, Dr. Myerson and his associates found it possible to puncture with a syringe both jugular vein and common carotid artery, to withdraw relatively large quantities of blood, and then to analyze this blood to see what materials in it the brain uses. The patient need not be unconscious as the operation is performed under novocain local anesthesia. The cause of many kinds of insanity and the usefulness of various treatments may be decided from experiments on the insane by this new technique. That the brain either uses or withdraws more sugar from the blood than does the arm is one of the first conclusions reached through use of the new method. The brain uses or stores during anesthetization less than half the sugar used normally.

ANOTHER difference between the nervous, energetic person, who usually has a high metabolic rate, and the slow, easy-going character, whose metabolism processes are often sluggish, was reported to the American Association for the Advancement of Science by Dr. Charles Sheard and Charlotte Purdy, of the Mayo Foundation, Rochester, Minnesota. Persons whose internal fires burn at a rapid rate were found to generate small differences in electrical potential between two points on

their arms or legs, while persons with low metabolic rates have higher electrical differences between like points on their bodies. Although this electrical characteristic, measured between points about three inches apart on the arms and legs, is the same as that which power companies account for in terms of volts and thousands of volts, on human beings its magnitude is limited to just a few thousandths of one volt. Potential differences as measured on the skin are also increased by an emotional storm or a hearty meal, but emotions and meals do not have as much influence on the electrical measurement as on metabolism.

PROFESSOR J. WILLARD HERSHEY, of McPherson College, Kansas, reported that oxygen and nitrogen, chief constituents of the air, are not alone sufficient to keep life aglow. His experiments showed that animals die after living ten days to three weeks in air from which carbon dioxide and rare gases, helium, argon, krypton, etc., are removed. Professor Hershey predicted that helium atmosphere would be used in fighting diseases just as oxygen atmospheres are now utilized in treating pneumonia. Large factories and office buildings supplied with synthetic atmospheres in which oxygen is mixed with helium instead of nitrogen are also foreseen by Professor Hershey as a result of his tests.

VERTEBRATE animals have been traced back to an obscure race of sea scorpions, now known only as fossils, by Professor William Patten, of Dartmouth College. The connection between the highest vertebrate forms and these humble ancient arachnids of a thousand million years ago links through the extinct group of sub-fishlike creatures called ostracoderms. For years Professor Patten has held for an ancestry of vertebrates through ostracoderms, but certain fossil evidence has been lacking. Now, from the island of Oesel, in the Baltic Sea, come well-preserved ostracoderm specimens that fill the gap. They show how the face of the vertebrate type of animals was founded by the union of a number of skeletal arches in the mouth region of the ostracoderm. The outstanding feature of the change was the shift from the lengthwise, slitlike mouth of the invertebrate type, opening sidewise, to the typical cross-wise mouth of the vertebrate type, with jaws that work up and down.

EVIDENCE that roaches, among whose numbers are some of our worst house pests, evolved from termites, which sometimes literally eat our houses from under our feet, has been found in a species of wild roach living in the Appalachians and in certain localities in the Pacific Coast area. This was reported to zoologists in a communication from Dr. L. R. Cleveland, Elizabeth P. Sanders and S. R. Hall, of the Harvard Medical School. The evidence was literally found in the roaches, for it consists of certain one-celled animals, or protozoa, hitherto known only from the digestive tracts of termites. These protozoa serve their termite hosts by digesting the wood which is their exclusive diet. Without their internal equipment of protozoa the termites would starve, as Dr. Cleveland demonstrated several years ago,

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when he shared the association's annual thousand-dollar prize for a paper on his discovery. Like the termites, these woodland roaches are wood-eaters, and their internal protozoa apparently do their digesting for them.

DIETS for children are scrutinized for mineral contents, for the benefit of growing bones and teeth and other young tissues. From experiments reported before the American Society of Plant Physiologists by Dr. R. H. Carr, of Purdue University, it would appear that something of the same sort is in order for plants also. "It has been found," he said, "that the ashes of wheat, oats, alfalfa, tobacco and strawberries vary greatly according to the different soil types, even to such an extent that the 'mold' or 'pattern' of the plant and its degree of usefulness has been modified. Strawberries grown on a certain clay soil were found to be so highly mineralized that they remained firm and marketable four days longer than the same variety grown on a near-by loam soil. Wheat grown on a certain silt soil was found to contain 20 per cent. more ash and to produce a larger loaf of bread than the same variety grown on a productive loam soil in the same locality."

ARTIFICIALLY lengthening and shortening the daylight period for plants, for a number of years a scientific success, has been proved to be economically practicable by experiments carried on at Ohio State University by G. H. Poesch. He found that by shading his chrysanthemum greenhouses with black cloth he could produce an appreciably earlier marketable crop of flowers of correspondingly higher value. Conversely, he found that with plants responding to longer instead of shorter days, it was commercially practicable to give them four hours' extra illumination each day with 75- to 150-watt lamps. The current cost for one of the flower varieties used in

his test amounted to only half a cent a stalk of the marketable flowers.

ENGINEERS who two centuries ago first attempted to master the Mississippi River, should have begun at Cairo, Illinois, where the lower Mississippi begins, and not near New Orleans, where the river reaches the Gulf of Mexico, it appears from a report by Professor Floyd Nagler, of the University of Iowa. If engineers had started at Cairo with their dikes and levees and proceeded downstream, the folly of trying to exclude the Mississippi from all the surrounding plain would have been apparent. As it was, he stated, they began at the river's mouth and a full century of argument has been required to demonstrate conclusively that the Father of Waters must have several outlets into the gulf. The problem, he concluded, has been made one of flood protection where it should be one of flood passage.

A MILLION and a quarter square miles, or over forty per cent. of the area of the United States, comprising most of the best farm lands, is unwillingly shipping its tillable surface to Louisiana, which does not want the soil. The shipment is constantly on the way, via the Mississippi and its tributaries, to be dumped at the entrance to the Gulf of Mexico, as extensions of the troublesome and constantly growing Mississippi delta. The magnitude of the erosion menace was graphically shown in U. S. Coast and Geodetic Survey maps displayed at the scientific exhibit at New Orleans. Through two great breaches in its banks, called "crevasses," the Mississippi has poured silt to form over 40,000 acres of swamp, useful only for breeding muskrats. And constantly, under the waters of the gulf, this costly mud piles up new shoals which keep the scientists of the Coast and Geodetic Survey always on the alert because of their menace to navigation.

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THE MEASUREMENT OF INVISIBLE GERMS

GERMS so small that they can not be seen with the most powerful microscopes have nevertheless been measured and their size has been determined by a new method developed by Professor H. Bechhold and Dr. M. Schlesinger, of the Frankfort Institute for Colloid Research at Frankfort-on-Main.

This new development is of particular importance because a number of disease germs, notably those of smallpox, measles, yellow fever, rabies or hydrophobia, and possibly influenza and the common cold, are so small that they can not be seen even with the most powerful microscopes. Because they are invisible and the classic methods of bacteriology are not applicable to them, many investigators have come to the conclusion that they do not exist at all, and that the maladies said to be caused by them are in reality chemical intoxications by some unknown poisonous substances.

It was found by the new method that the germ of smallpox is from 21 to 23 hundredths of a micron in diameter. One micron is one thousandth of a millimeter, which in turn is about one twenty-fifth of an inch. The germ of chickenpox is smaller, having a diameter of from 12 to 13 hundredths of a micron, which makes it only about half as large as the germ of smallpox.

The bacteriophage, which preys on the germs just as they prey on animals and human beings, is very much smaller than these two germs, however. Its diameter measures between 12 and 20 millimicrons. Since a millimicron is one thousandth of a micron, this shows that the bacteriophage is about one tenth of the size of the tiny chickenpox germ, for instance, in the opinion of Drs. Bechhold and Schlesinger, its very small size seems to prove that it is no organism but a special stuff.

The size of these tiny organisms was determined by a simple method of combined filtering and centrifuging. Professor Bechhold devised ultrafiltration methods and consequently was able to procure filters with very small pores, having a diameter of $1/250$ millimeter. The centrifuge used made 10,000 revolutions per minute. Professor Bechhold found a general formula by which may be calculated the correlation between decrease of concentration and size of the particles of a semifluid substance centrifuged at high speed. From this formula and the known diameter of the filter pores, the size of the germs was determined. Inoculation into animals proved that the material measured was capable of producing the disease in question.

CENTRIOLES

MINUTE structures in the male reproductive cells, so small and fugitive that their existence has hitherto been doubted, have been given certain reality by the researches of Dr. H. Herbert Johnson, of the College of the City of New York. At a lecture before the section of biology, of the New York Academy of Sciences, Dr. Johnson gave the latest results of his work, together with a sum-

mary of the results of other researches in the same field, on which his own work has in part been based.

Dr. Johnson worked with the male reproductive cells of the cricket, because these give exceptionally clear, definite arrangements of the parts in which he was interested. He found that the "centrioles," or focal points towards which the heredity-bearing chromosomes move when cell division takes place, are definitely existing objects that survive the division of the cell and maintain their shape even when they are not actively at work. These centrioles are objects so tiny that many previous biologists had claimed they were merely distortions in the substance of dead cells due to the killing process. The most significant discovery, original with Dr. Johnson, was that in the crickets, due to a peculiar shape of the centriole, it could be definitely located in the living, unstained cell and thus can not be considered a distortion induced by death. Dr. Johnson has found that centrioles migrate with the sperm cell when it enters the egg to fertilize it, and he suggested that they may play an important part in the subsequent division and arrangement of the egg substance.

Another class of objects demonstrated by Dr. Johnson are the "dictyosomes," in connection with each of which is secreted a minute droplet of material which unites with other similar droplets collectively known as the "vacuome" to form a larger drop which takes its place at the tip end of the sperm cell. Certain chemical tests suggest the possibility that this vacuome may be very important in the sperm's entry into the egg, besides exciting a chemical response on the part of the egg, perhaps digesting a path in the egg substance for the sperm to pass through.

THE IONIC CONTENT OF AIR

CONCLUSIVE evidence that minute electrified particles of the air, known to scientists as ions, are the real cause of fresh, invigorating atmosphere is being sought at the Harvard School of Public Health in Boston by Professor C. P. Yaglou, assisted by L. Claribel Benjamin and Sarah P. Choate, technicians. These workers reported results of their research, at Cleveland, before the annual meeting of the American Society of Heating and Ventilating Engineers.

The studies consisted chiefly in measuring the number of ions in different kinds of atmosphere. They indicate that atmosphere which is considered "deadening" to the breather is likely to contain only a small number of ions per unit of volume.

Professor Yaglou told *Science Service* that at the present state of the research he would not be justified in saying that "dead" air can be made fresh and invigorating simply by increasing the ionic content with an electric apparatus. "The consensus of opinion among our experimental subjects," he continued, "seems to indicate that highly ionized air is fresher than air of

low ionic content, but the number of observations is too limited to draw definite conclusions at this time."

Professor Yaglou and his assistants found that the common rate of ventilating buildings is entirely insufficient to maintain the normal ionic content of the air in a crowded room, the necessary rate of 160 cubic feet per person per minute being prohibitively high. But with electric apparatus they were able to keep the ionic content of air in a crowded room at a high figure when outdoor air was entering at the usual rate of ventilation of thirty cubic feet per person per minute.

"In contrast with the prevailing belief," they stated, "the ionic content in unoccupied heated rooms did not differ much from that out of doors, and in cold weather it was often higher, owing probably to a temperature effect."

The concentration of ions in the air changes both seasonally and daily. There were said to be more ions in the air during the summer than in winter, on clear days than on rainy, foggy or gray days, and, as a general rule, the concentration is higher during the day than at night. In nature, ions are produced by solar radiation, by cosmic rays and by radioactive changes in the soil of the earth.

THE RADIATION OF HEAT FROM THE SKIN

THE human skin is an almost perfect insulator against radiated heat. To get heat through it, the skin must itself be warmed up and allowed to do the radiating. This information is one of the results of research conducted by L. B. Aldrich, of the Smithsonian Institution, on practical problems connected with heating and ventilation of schoolrooms and similar places, where numbers of human beings sit for hours, warming each other and the surrounding atmosphere and furnishings with their bodily radiation. The technical results are published in full in a Smithsonian Institution bulletin recently issued.

After measuring with electrical instruments the heat radiated by a number of human subjects, Mr. Aldrich suspected that it might not all be coming by radiation from the surface of the skin. A part, he thought, might possibly be radiating directly through the skin. So through the assistance of a hospital surgeon he got a fresh piece of human skin, for which the original owner had no further use, and made direct tests. He found that it would stop heat waves almost completely. It therefore appears that the heat from the interior of the body must be transmitted to the skin, largely through the circulating blood, and then radiated from its surface, instead of being shot straight through it from beneath.

Mr. Aldrich applied his measurements to the practical heating and ventilating problems presented by a crowded schoolroom, using well-known physical and engineering formulae. In his report, he reduces his results to terms of common understanding. He says, in part:

"As a rough example, assume a class of students placed in rows, with spaces of two feet between students in a row, and the same distance between rows. To simplify matters, imagine each student to be cylindrical, one foot in diameter and four feet high. The four students nearest to a given student would occupy roughly

10 per cent. of the total space to which the central student is radiating. The four next nearest students exposed to the given student would occupy an additional 5 per cent., and the eight next nearest another 4 per cent. Summing up, the amount of space occupied by surrounding students would be about twenty-per cent. of the total space to which the central students radiate.

"If we reduce the space between students to only one foot instead of two and proceed to sum up in a similar manner, the area occupied by the other students increases to about 35 per cent. of the whole. For a spacing of three feet between students it reduces to only 10 per cent. In other words, when students are spaced one foot apart, the total radiation loss of each student is some 35 per cent. less than if he were alone in the room. When the spacing is two feet between students the radiation loss is 20 per cent. less than if he were alone, and when the spacing is three feet the radiation loss is 10 per cent. less. These rough figures serve in a general way to show the relationship between the spacing of students and the radiation loss of individual students."

WEATHER AND THE GULF STREAM

THE Gulf Stream is not coming closer to the southeastern and central Atlantic coast and even if it should any change of its course would have practically no effect on the climate of the United States.

Thus may be summarized information gathered from the Hydrographic Office of the U. S. Navy and from the U. S. Weather Bureau in response to reports stating that movement of the Gulf Stream closer to the coast was partly responsible for recent abnormally warm weather.

Investigators of the Hydrographic Office stated that they have received no information which indicates a change in the course of the ocean current. It was pointed out, however, that since the limits of this current are not sharply defined and since it eddies and swirls beyond its normal boundaries, temperature readings may have been reported which without sufficient study might be taken to indicate that the stream has changed its position.

But Mr. W. F. McDonald, chief of the division of marine meteorology of the Weather Bureau, holds that in so far as the weather of the United States is concerned, there is little point to a consideration of the possibility of a new course for the current. Mr. McDonald pointed out that since prevailing winds over the United States and the North Atlantic ocean blow from west to east, the Gulf Stream has more effect on the weather of Europe than on that of this country. He also said that the temperature of the stream as measured in the Florida straits by boats plying between Florida and Cuba has not increased appreciably during or immediately preceding the warm weather.

Additional evidence to show the negligible effect of this current was given by J. B. Kincer, chief of the division of agricultural meteorology of the Weather Bureau. The states which are closest to the Gulf Stream and which should receive its greatest effect, Mr. Kincer said, were actually cooler than normal during the

winter of 1930-31, and for the entire record-breaking hot year of 1931 average temperatures rose less above normal in these states than in any other part of the country.

Influence of the almost entire absence of icebergs in the North Atlantic during the past season is discounted as a cause of the warmth by Commander Edward H. Smith, of the U. S. Coast Guard. Commander Smith, who has conducted expeditions to study the source of icebergs, says that the cooling effect of melting ice on the Labrador current is slight.

PAPERS PRESENTED AT THE NEW ORLEANS MEETING

(Continued from the issue of February 5)

FINAL scores of a shooting match in which the bullets were electrons and the targets were atoms of the rare atmospheric gas, argon, were reported to the American Physical Society by Professor A. L. Hughes and Dr. J. H. McMillen, of Washington University, St. Louis. It was found that most electrons bounce off atoms elastically, that is to say, without loss of speed. These electrons for the most part, come off at small angles, that is, they are deviated but a small amount from their original direction. Others of these elastically rebounding electrons are diverted through large angles. Certain large-angle deflections are preferred to others; the effect may be described as the production of electron haloes. This result supports the view that electrons can be particles and waves at the same time. In other collisions, an electron rebounds inelastically, *i.e.*, it gives up a part of its energy either to excite the atom, in which state it can give out light; or to ionize it, which is to say that another electron is ejected out of the atom by the colliding electrons. The colliding electron, as a rule, goes through the atom with but little change of direction, although it loses speed. If it ejects an electron from the atom, the ejected electron may come out in any direction, but with a decided preference for directions opposite to those of the colliding electrons.

How scientists of all nationalities are planning a concerted attack on the weather secrets of the Arctic and Antarctic during the year 1932-33 was described by Dr. Herbert H. Kimball, of the U. S. Weather Bureau, Washington, D. C. Weather forecasting in the temperate regions will be immediately aided by this work, Dr. Kimball explained. For practical forecasting purposes, atmospheric processes in the polar regions of both hemispheres play a predominant part in determining the weather of moderate latitudes. The original "Polar Year" investigations of 1882-83 have never been repeated, Dr. Kimball said. The planned expeditions for next year, involving the setting up of forty separate stations in the Arctic, will be the jubilee of the first polar year. Most of these stations will be in radio communication with high-power meteorological stations at low altitudes and so the results will be available for charting by forecasters all over the world on a uniform basis almost immediately after they have been made. Three chief classes of observations will be made under the Polar Year plan: magnetic, auroral and meteorolog-

ical. Dr. Kimball's report dealt only with the work on weather. This work will include preparation of weather maps showing the temperature and pressure of the atmosphere, the wind velocity and the amount of moisture in the air. There will also be investigations of air currents and exploration by balloon and airplane of the conditions of the air over the polar regions.

By using invisible ultra-violet light that can be seen by photographic plates but not by human eyes, it is possible to picture in greater detail the fine microscopic structure of various substances, Mr. A. P. H. Trivelli, of the Eastman Kodak Research Laboratories at Rochester, New York, reported to a meeting at the Franklin Institute. With ultra-violet light just beyond the limits of visibility it is possible to focus the special microscope with green visible light and then take the photograph with mercury vapor lamp light of 365 millimicrons wavelength. For shorter wave-lengths of the invisible light, the focusing has to be done in the dark by trial and error photographs. At wave-lengths of 180 millimicrons the air itself becomes opaque to the light and it is necessary to work in a vacuum or in an atmosphere of nitrogen. Quartz must be used for lenses in all ultra-violet light work, except that with the longest wave-lengths, but Mr. Trivelli found that at 150 millimicrons wave-length even quartz became opaque.

FOURTEEN points for the government of the atom nucleus have been formulated by Professor William D. Harkins, of the University of Chicago. The stability and formation of the ninety-two elements of the chemist's periodic table of atoms are intimately governed by them. They relate particularly to the atomic weight and the atomic number, or order number of the element in the table. Nature is most often even in making her atom cores, Professor Harkins finds. Nearly all atomic nuclei contain an even number of electrons. The atomic number and the number of protons in the nucleus are generally even, too. Elements of even atomic number, the newest data indicate, are ten times more abundant on the surface of the earth or on the sun. In meteorites the atom nuclei of elements of even atomic number are fifty times more abundant.

THE methods of measuring the Lenard or electron rays have been perfected by an investigation of Dr. Lauriston S. Taylor, of the U. S. Bureau of Standards. Lenard rays are obtained by pushing electrons through a vacuum tube under a pressure of several hundred thousand volts. By use of a small window of metal or glass the speeding electrons can be obtained in the air outside of the tube. As they have been used, since their first production in large quantities by Dr. W. D. Coolidge, for a great variety of chemical and biological purposes it is important to have an accurate method of measuring them. Three methods of measuring the rays were compared. Of these the use of a "Faraday chamber" was found to be most effective. This consists of two metal chambers enclosed one within the other and having openings through which the electrons may pass to the inner chamber.

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A pink organ in the cheek, which flashed with a bluish luminescence, was the only part of the fish to glow without the use of adrenalin.

The same "lighting" effect was achieved with second, third and fourth injections of adrenalin; but the stimulant was unavailing upon fish which had been dead for some time. Dr. Harvey's experiment was a second example of stimulation of luminous fish with adrenalin, a previous one having shown that surface-dwelling forms are likewise affected.

Ability of organisms to produce light is due, Dr. Harvey points out, to the slow burning of a substance, luciferin, in the presence of an enzyme, or a substance which assists the chemical reaction without actually being a part of the resulting product. The name of this enzyme is luciferase.

Dr. Harvey prepared solutions of these two substances from a crustacean, Cypridina, and a deep sea shrimp, Systellaspis. He discovered that the mixing of luciferin of one organism with its own enzyme would give plenty of light; if, however, he tried the solutions from the shrimp on those of the crustacean, he got no results.

Light will be produced, Dr. Harvey found, when appropriate solutions from closely related animals are used. He called attention to an interesting experiment that can be carried out with two species of fire-flies, where the luminescence of each differs in color. The luciferin of one species, which gave off yellowish light, was mixed with the enzyme of the other species, whose light was reddish.

The result was not what the person familiar with water colors would expect. Instead of getting light from the mixture which had an intermediate orange color, Dr. Harvey got reddish light, showing that the enzyme is the real source of the luminescence.

THE CAUSE OF THE EPIDEMIC AMONG HORSES IN THE WEST

A GERM of the filterable virus type is the cause of a rapidly spreading and serious disease of horses and mules which has been epidemic in western states, particularly California, during the past several years, as shown in studies by Professor C. M. Haring and J. W. Haworth, of the University of California Agricultural Experiment Station, and Professor K. F. Meyer, of the Hooper Foundation. About 6,000 head were affected in California in one season, 3,000 of these animals dying, according to the report to the *U. S. Army Veterinary Bulletin*.

The virus attacks the brain and spinal cord of the animals, which gives it the scientific name, encephalomyelitis. It is popularly known as Kansas-Nebraska horse plague. Horses and mules are the only animals known to be affected under farm conditions, although the University of California studies showed that the infective virus found in the brain and spinal cord of sick horses can produce the disease in horses, monkeys, rabbits, guinea-pigs, rats and mice when injected into the brain or even when dropped into the nostrils. In California, no cases have been reported in animals other than those kept on farms.

No specific treatment generally applicable to all cases has been found, but studies of the virus are now being actively carried on at the University of California. Treatment at present is being directed toward relieving symptoms. Stock owners are advised to prevent association of horses from infected areas with those from non-infected areas and to keep horses away from streams, canals, ditches and pools, and to provide an abundant supply of fresh well water.

Two types of the disease occur: the sleepy type in which the animals drowse until disturbed, when they may have convulsions, and the walking type in which the animals pace around and around the field. In severe cases the animals fall down and are unable to get up or roll over. Recognition of first symptoms is important because the chances of recovery are greater in animals that are carefully treated and nursed from the very beginning. Unwillingness to be led, lack of spirit, slight wobbly gait, failure to come when called, or, in unbroken colts, failure to run when approached are early indications of the disease.

SEPARATING PARTICLES BY MAGNETISM

A MAGNET so powerful that it will attract substances commonly considered non-magnetic and so separate valuable from worthless minerals was described before the American Institute of Mining and Metallurgical Engineers at its meeting in New York.

Under the force of modern electromagnets more than twenty times as powerful as an ordinary permanent magnet, slate has been taken from coal in the reclamation of vast heaps of mine scrap, it was said, and even common sand of the seashore has been divided into piles of light grains valuable in industry.

The magnet does not lift particles vertically from their fellow particles, it is explained in the report describing the new process which was prepared by S. G. Frantz, of Princeton, and G. W. Jarman, Jr., of New York. But the lines of magnetic force are exerted against a falling stream of particles to force those of greatest magnetic susceptibility beyond a vertical partition.

Thus only a small force is required to divert from their vertical fall substances that respond very slightly to magnetism. So powerful are the magnets now used that they separate materials having a magnetic susceptibility only one one-hundred-millionth that of iron.

"Use of the process is of interest to the ceramic industry for the removal of faintly iron-stained particles from sands and clays which go into the manufacture of glass and sanitary ware," they said. "It is also of interest to all producers of non-metallic materials such as bauxite, coal, fluorspar, kyanite, barite, the rare earths and other substances."

RADIUM IN THE CANADIAN NORTHWEST

Two new rich radium-bearing ore veins were discovered at Great Bear Lake, in northwest Canada, just before the winter freeze-up stopped further prospecting, Hugh S. Spence, Canadian Department of Mines expert, reported at conferences with Washington geologists.

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Mr. Spence, as official visitor to the radium strike in Northwest Territories, himself aided in the discovery of the new bodies of pitchblende ore.

Earlier reports of the rich finds of Gilbert LaBine, discoverer of the original radium ore deposits, were authenticated by Mr. Spence, who stated to a Science Service representative: "Beyond any question the pitchblende deposits at LaBine Point constitute a very valuable source of radium. At the present value of radium, ore could easily meet the \$400 per ton cost of shipment to the railroad."

More and larger amounts of pitchblende than yet found, containing at present prices, \$6,000 to \$8,000 worth of radium to the ton, may yet remain to be discovered, Mr. Spence predicted. Two of the veins have been traced for distances of 1,400 and 2,500 feet and all four seem to run together like the fingers of an outspread hand. A still larger and more valuable deposit, he said, may lie at the "wrist" somewhere to the northeast of the present workings.

Another new strike of the precious pitchblende, 12 miles distant from Echo Bay where the first vein of LaBine's Eldorado Gold Mines, Limited, was located, has already been reported on the ground of the rival Northern Aerial Minerals Exploration Company.

Planes were arriving during all the time of his stay at LaBine Point on the Great Bear Lake, Mr. Spence said. These were carrying prospectors on the look-out for further silver deposits. LaBine's number two pitchblende vein interlaced with valuable native silver veins, the best so far discovered in the region, assaying some 9,000 ounces to the ton, had roused the hopes of these adventurers.

Only two men are on the ground at present because of the freezing weather, but mining operations will be started again next month. Fourteen surface pits were being worked at the time of his visit last summer. The ore obtained from these by hand picking averaged 50 per cent. uranium oxide or about one gram of radium to eight tons of ore.

PLANTS BLOSSOMING IN WINTER

FOR all its reputation as a semi-Southern city, the national capital normally gets its share of winter weather; so that it is a bit of an experience for Washingtonians to find things like pansies and pinks in their front yards all winter long.

Professor J. B. S. Norton, of the University of Maryland, has compiled a list of over fifty plants seen in blossom in the District of Columbia since the beginning of December. Some of them represent persistent survivors of the summer and autumn of 1931, others are precocious comers heralding the spring of 1932.

Among the cultivated ornamentals, Professor Norton's list includes roses, pinks, chrysanthemums, zinnias, verbenas, pansies, sweet alyssum, candytuft, phlox, crocuses, hyacinths, paper-white narcissi and irises. The latter are especially noteworthy, for they are not the dwarf irises that appear normally in March or perhaps even late February, but the tall Germanica types, that normally wait until late April or May.

Trees and shrubs seen in bloom are elm, hazelnut, Forsythia and soft maple. Professor Norton has kept records of soft maple, as the earliest of all spring bloomers, for several years, and has never seen it as early as he has this year.

Among wildflowers, wild asters persisted well into December, and violets have been in bloom all winter through. Early comers have been bluets and hepaticas. Oddly enough, however, that earliest of all harbingers of spring, the skunk cabbage, has not yet been seen.

Nor have the weeds been behindhand. Dandelions have been as persistent as the violets in the woods and the pansies on the lawns; and other entries on the list are peppercress, shepherd's-purse, ox-eye daisy and chickweed.

ITEMS

EXPERIMENTS at the Bureau of Standards show that cornstalks may be used to make a substitute for lumber, the annual report states. Subjecting a mat of the fibers to heavy pressure gives a product which is hard, dense and strong, and equipment for semi-commercial production of this artificial lumber is being designed. Insulating wall board resistant to fire and water is already manufactured commercially from cornstalks. Wheat straw is under test as a possible source of paper, though results have not yet been entirely satisfactory. Sugars, which may find use in medical laboratories, have been prepared from cottonseed hull bran. Investigations are under way to find out whether a starch useful in textile industries can be gotten from sweet potatoes. A cheap, effective method of refining cottonseed oil has also been developed. Improved means of obtaining kraft paper from southern pine are likewise being studied.

FOR the first time in the educational history of this country, a policy of x-raying the lungs of all members of the entering classes in all departments of a university has been adopted. This measure was put into practice by Yale University as a further means of safeguarding the health of its students. The x-ray films are made with a view to determining the presence of tuberculosis in any of its manifestations. All students whose chest pictures show indications of trouble are to be carefully followed during their college courses and x-ray pictures of their chests will be made at least once a year. Stereoscopic x-ray films were made last year of 1,602 new students. A total of 283 students, or 17.7 per cent. of those examined, gave evidence of an amount of infection potentially dangerous but, in most cases, not destined to cause trouble.

THE "Katahdin," a new variety of potatoes resistant to the highly troublesome mosaic disease, has been tested by the U. S. Department of Agriculture in all sections of the country and found to be well adapted to the climatic conditions in almost all the states. It was bred by the Department of Agriculture specifically to fight mosaic disease and is highly successful in this, though it is still somewhat susceptible to the related diseases, leaf roll and spindle tuber. No seed tubers are available for commercial distribution, however, for it is felt that further tests are still desirable.

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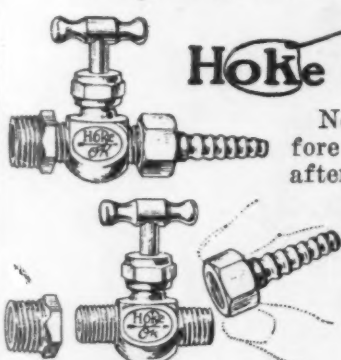
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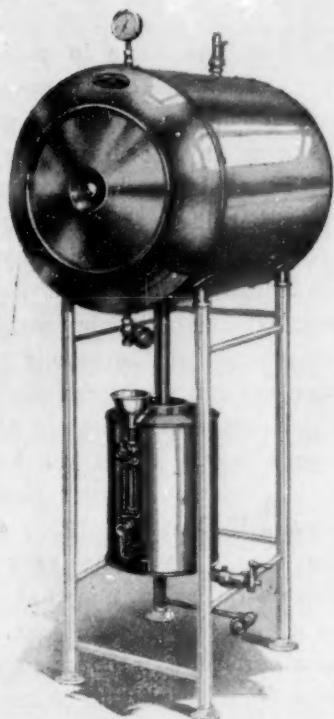
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SCIENCE NEWS

Science Service, Washington, D. C.

THE PRODUCTION OF ARTIFICIAL
COSMIC RAYS

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COSMIC RAYS, the most piercing radiation known to man, have been produced artificially for the first time at the Physical Institute of the University of Giessen by Professor W. Bothe and Dr. H. Becker. The process gains energy at the expense of the matter in the atom nucleus and thus realizes the old hope of tapping the energy of the atom.

Beryllium metal, bombarded with alpha particles from the radioactive element polonium, was in these experiments made to emit rays as penetrating as 14 million-volt x-rays so far unattained by man. The new rays are so penetrating that after passing through nearly 3 inches of iron they have lost only a third of their intensity.

Previous experiments on the bombarding of atoms with alpha particles, which are helium atom nuclei moving at high speed, have resulted in the production of proton rays, the speeding hearts of hydrogen atoms. Artificial transmutation of the target atom nucleus into another chemically different element had thus been attained by the loss of the hydrogen nucleus.

Drs. Bothe and Becker found, however, that beryllium gave off no protons when bombarded by alpha particles. The alpha particle entered the nucleus of the beryllium atom which at the same time emitted cosmic rays holding much more energy than the impinging alpha-particle projectiles.

Hitherto unknown carbon atoms of atomic weight 13 were thus formed from each of the beryllium atoms hit. This achievement constitutes a new type of transmutation of a chemical element. The process can be represented by an equation similar to those used to picture chemical reactions.

Six of the light chemical elements, Drs. Bothe and Becker found, gave the artificial cosmic or hard gamma rays under the action of the polonium alpha particles. These elements were: lithium, beryllium, boron, fluorine, magnesium and aluminum. Of these, beryllium gave by far the most intense secondary rays and therefore was most suitable for experiments. Some of these elements also emitted proton rays.

Professor Bothe has sent to Science Service the following account of his work:

"Our experiments show that energy is gained if any alpha particle is shot into the beryllium nucleus. That is to say, by addition of an alpha particle to the beryllium nucleus, a carbon nucleus of atomic weight 13 is produced which contains less energy than the two original nuclei together.

"These experiments give a hint as to the way in which the building up of the atom nuclei actually takes place in the universe: The heavier nuclei are produced by steps from the lighter. The hypothesis which Dr. Robert A.

Millikan has made to explain the 'ultra-rays' (cosmic rays), that the heavy nuclei are formed direct by the sudden combination of a great number of protons and electrons, is accordingly very improbable.

"In still another connection the gamma radiation from beryllium is of interest in connection with the problem of the cosmic rays. The new rays are much harder than the known radioactive gamma rays, their penetrating power approaches close to that of the softest components of the cosmic rays. Thus in the beryllium rays one can study the properties of a gamma radiation which has approximately the penetrating power of the cosmic rays. As is well known, my earlier experiments with Professor Werner Kolhorster (reported by Science Service in January, 1930) showed that the properties of the cosmic rays are very different from those of a gamma radiation, and that the cosmic rays behave rather as a corpuscular radiation. Dr. H. Becker and I have now carried out the same experiments with the gamma rays from beryllium; it turns out that these still behave completely like a normal gamma radiation and quite differently from the cosmic rays. This is further strong support for the idea that the cosmic rays have a particle-like nature in the lower layers of the atmosphere.

"A series of other light elements, as well as beryllium, can be artificially excited to gamma ray emission. The production of artificial gamma rays is just as general a phenomenon as the breaking up of atomic nuclei. In this radiation we have a means of studying the structure of the lighter atomic nuclei; we are standing at the threshold of a 'nuclear spectroscopy.' Indeed the light atom nuclei are of special interest. They are most simply built, and we can here first expect to penetrate the still unknown principles of nuclear structure."

THE TOTAL ECLIPSE OF THE SUN ON
AUGUST 31

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A NEW record for the number of astronomical parties observing a total eclipse of the sun will be set on August 31 of this year when the moon's shadow passes across eastern Canada and New England.

Word has been received of sixteen institutions whose representatives will be in the path of the shadow, and probably a number of others will also send astronomers to make observations only possible when the moon hides the sun. Hundreds of other professional and amateur students of the heavens will go to see this rare phenomenon, generally regarded as the most impressive of natural spectacles.

Eight of the scientific parties now planned are from American institutions, two from Canada, four from England, and one each from Russia and Japan. The path along which they will be located is about a hundred miles wide and passes south of Hudson Bay, across Quebec, over the St. Lawrence River from a point about

eight miles west of Montreal to one about 25 miles east of Three Rivers. Both these cities are therefore well within the band of totality.

Entering the United States, the path crosses northeastern Vermont, New Hampshire, except the southwestern corner, southwestern Maine, the northeastern corner of Massachusetts and Cape Cod. The shadow will cover the Atlantic coast between Salem, Massachusetts, and Boothbay, Maine.

The most northerly accessible point from which to observe the total eclipse is Parent, Quebec, on the Canadian National Railway about 185 miles northwest of Montreal. Two expeditions, those of the Dominion Observatory at Ottawa and the Royal Observatory at Greenwich, England, are expected to make this town their headquarters. At Sorel, Quebec, on the St. Lawrence River, close to the center of the path, the expedition from the McCormick Observatory of the University of Virginia will be located. Astronomers of McGill University, at Montreal, will make observations from their own city where they will be joined by a group from the University of London. Astronomers from Cambridge University will go to Magog, Quebec.

Most of the parties in the United States have chosen the vicinity of Conway, New Hampshire, including North and Center Conway, and Fryeburg, Maine, as observation points. Groups from the Lick Observatory of the University of California and the Sproul Observatory of Swarthmore College will go to Fryeburg. Near Center Conway will be a party from the Van Vleck Observatory, of Wesleyan University. Representatives from the Franklin Institute, Philadelphia, will go a little farther west, to Conway, according to tentative plans. The group from the Perkins Observatory of the Ohio Wesleyan University will locate at Douglas Hill near Sebago, Maine. At this same place will be a party from the Royal Astronomical Society, London.

Other expeditions from the Mt. Wilson Observatory, the University of Indiana, the Kwasan Observatory of the Kyoto Imperial University, Japan, and the Central Astronomical Observatory at Pulkova, Russia, are expected.

Most of the observations to be made by these astronomers, if cloudy weather does not make the elaborate preparations in vain, will be photographs of the solar corona. The corona is the outermost part of the sun, so faint that it is generally invisible because of the great glare from the light of the inner part. When the solar disc is covered by the moon, at the time of a total eclipse, the corona becomes visible.

In addition to direct photographs, in black and white, natural color and motion, made through cameras ranging from small kodaks to huge astronomical instruments as much as 85 feet long, spectroscopic photographs will be made of the corona to determine its composition and motion. Other spectroscopic observations will be of the flash spectrum, seen when the last sliver of sun is visible just before the moon completely covers it, or when the first bit reappears just after the total phase is over. Such observations give valuable information about the sun's atmosphere.

Still other observations to be attempted will be photo-

graphs of the shadow bands, which appear on the ground before and after the total eclipse, and of the shadow of the moon, as it sweeps over the earth. One observation that has engaged the attention of astronomers at recent eclipses will be lacking, however. This is the photography of stars close to the sun to determine whether their light is deflected by the solar gravitation, as predicted by Einstein. There will be no stars sufficiently bright in the sun's neighborhood at the time of the August eclipse.

THE CHEMICAL ELEMENTS VIRGINIUM AND ALABAMINE

THE chemical method that enabled the finding of the last two chemical elements, virginium and alabamine, was itself discovered by following up an apparent experimental blunder, according to Professor Fred Allison, of the Alabama Polytechnic Institute, who spoke at the recent meeting in New York City of the American Institute of Mining and Metallurgical Engineers.

At first investigators doubted the power of the magneto-optic apparatus to detect one part of a chemical substance in a hundred billion of water which contained numerous other substances in solution. The apparatus, however, was perfected from an accidental beginning, and has proved itself completely successful. Besides making possible the discovery of the most elusive elements, numbers 85 and 87, it has proved the existence of the new double-weight hydrogen isotope and has discovered for the first time new isotopic atoms of seven heavy metals, including gold and platinum.

The four models of the apparatus in operation at Auburn have given completely concordant results in the hands of competent observers, even when the amounts of substance were too small to be found by any other method of analysis. An improved form of the apparatus at Emory University, Atlanta, Georgia, has been used by Professor J. L. McGhee and Margaret Lawrenz to verify Professor Allison's analyses.

Professor Allison believes that wide applications for the magneto-optic apparatus, which depends on the time lag in the effect observed when a beam of polarized light passes through a magnetized column of the liquid to be analyzed, will soon be found.

Not only will the method detect extremely small amounts, but it can tell how much is present. The magneto-optic method has the advantages that the analysis can be carried out in the presence of other substances and that the sample itself is not affected by the process as in a routine chemical analysis.

FOG PARTICLES

THE smallest of the fog particles that hinder flying and ocean travel are so minute in size that 25,000 of them could be placed end to end within the space of an inch.

This was discovered at the Massachusetts Institute of Technology at the Round Hill research station where individual fog droplets for the first time were measured and photographed. Mr. Henry G. Houghton, Jr., made the fog measurements with a special microscope that catches on a greased slide the individual droplets as flies are trapped on sticky paper. Natural fog is allowed

to drift across the flat glass slide upon which the microscope is focussed and finely ruled lines and cross lighting allow the measurements of a hundred or more fog particles in a few minutes.

Fogs are not composed of particles all of one size, although one size usually is most prevalent. Different fogs have different particle sizes, but they are found to range from two twenty-five hundredths to one twenty-five thousandth of an inch in diameter (one to 20 microns).

These measurements were made as part of a comprehensive study of fogs, directed by Professor Edward L. Bowles and undertaken by Mr. Houghton and Dr. Julius A. Stratton.

Practical aids to aviation fog signalling may result as large particle fogs are known to be penetrated most easily by red light while fogs of very small droplets are best signaled through by green light. Other studies show that most sea fogs are caused by the formation of water about invisible grains of salt tossed into the air from breaking waves.

THE OYSTER INDUSTRY AND WASTES FROM PULP MILLS

MILLS using the sulphite process in the manufacture of paper pulp may be prohibited from emptying their waste products into waters where oysters are grown. Investigation by agents of the U. S. Bureau of Fisheries, just made public, point to the sulphite waste liquor as the cause of the abnormal conditions in certain oyster beds. Recommendations have been made by the agents that pulp mills dispose of their wastes otherwise.

In response to a plea of oystermen in the Pacific Northwest, Drs. A. E. Hopkins, P. S. Galtsoff and H. C. McMillin, of the Bureau of Fisheries, made a study of conditions at Oakland Bay, on Puget Sound, where the once thriving oyster industry has almost ceased. They reported that the waste liquor given off in the sulphite process could be made to produce, experimentally, a high death rate, poor quality of meat and lack of shell growth among oysters. These abnormalities are now characteristic of Oakland Bay, into which a pulp mill empties its waste liquor.

When pulp is manufactured by the sulphite process, the chips of wood are cooked under pressure in a solution consisting primarily of calcium bisulphite with an excess of sulphurous acid. The resulting syrupy liquid, dark reddish-brown in color, contains, in addition to the substances of the cooking solution, nearly all the non-cellulose constituents of the wood.

Oysters, which the investigators placed in a mixture of this liquor and sea-water, either died outright or remained closed so much of the time that the food taken in was insufficient to produce healthy meat. The liquor was also shown to irritate the lining of the oysters' gills in such a way as to reduce the rate of feeding. The concentration of the sulphite liquor giving these effects was not greater than that now present in Oakland Bay.

Sewage and sawmill products in the bay were investigated and were held not to be responsible for the oyster setback. Checks on results obtained were made with oysters from other areas and with unpolluted water.

Barnacles, mussels and certain plants were found not to grow on boats or other floating equipment in water containing sulphite liquor.

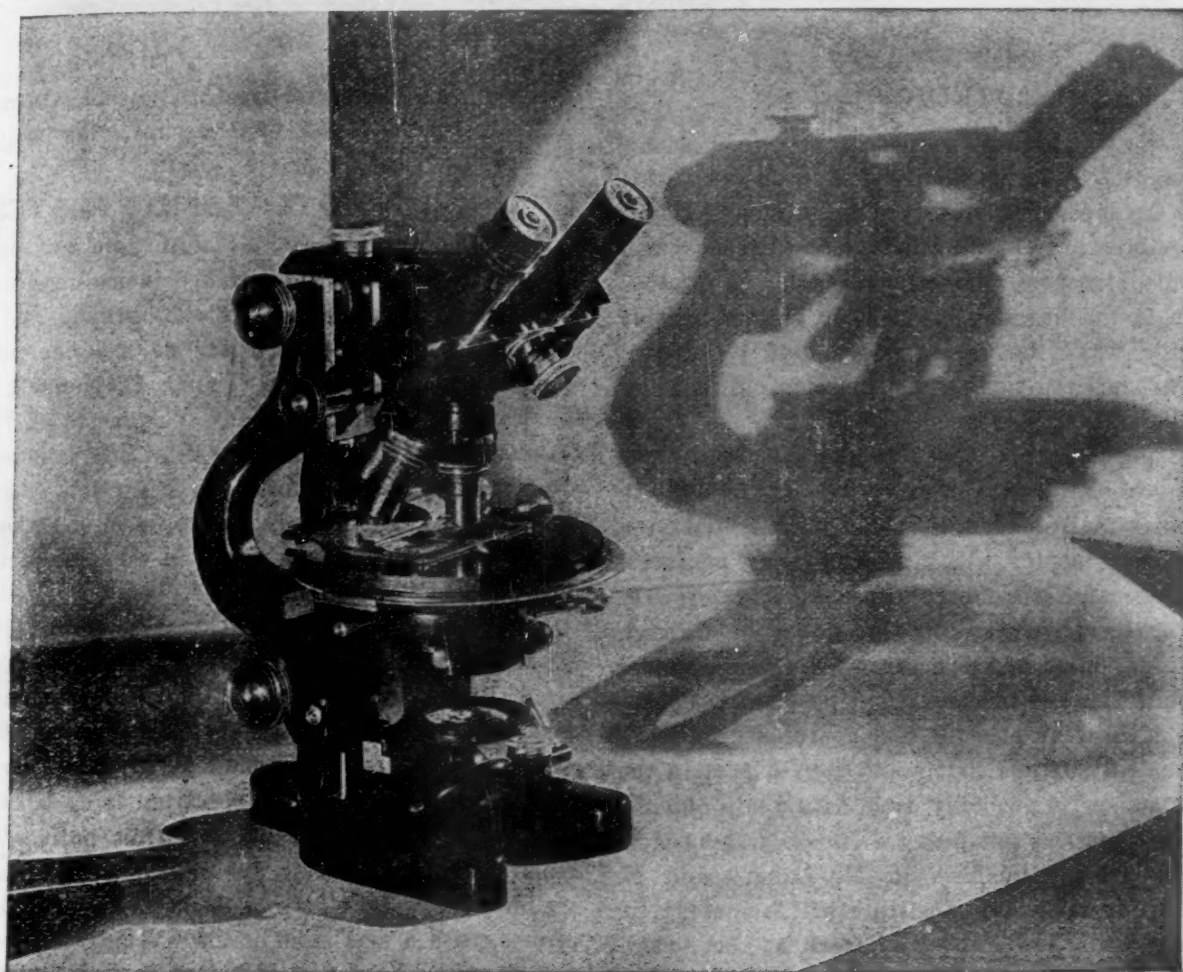
The condition of the oyster industry at Oakland Bay has become serious. Very few oysters form sexual products and spawn, and no set of oysters has been obtained for three years. It is believed that the pollution of the water in Oakland Bay by the sulphite liquor caused the death of practically every young, or larval, oyster.

ITEMS

INFLUENZA cases increased throughout the country during the past week, reports received at the U. S. Public Health Service indicate. For the week ending February 13, a total of 6,664 cases were reported. The far west seems to have the largest outbreak. South Dakota reported an estimated total of 1,200 cases. The week before only 9 cases were actually reported from this state. Other states reporting high figures were South Carolina, Oklahoma, Oregon, Kentucky, Tennessee, Texas, Wyoming, Indiana and Wisconsin. Unfortunately, some quite populous states, among them New York and Pennsylvania, do not require the reporting of influenza cases, so that the actual total for the country can not be determined. Even in states requiring influenza reports, the figures do not always represent the full extent of the disease, partly because practicing physicians do not agree on the diagnosis of influenza, and partly because some cases of it never come to the attention of physicians or health officers.

"PARTHENOGENETIC" embryonic structures have been found in virgin guinea-pig ovaries several times in the past by Professor Leo Loeb, of Washington University Medical School, St. Louis, and he has now made observations that confirm his earlier work. Although the production of fatherless young is a commonplace occurrence in many animals, of which the ordinary aphid or plant louse is perhaps the most widely distributed example, it has never been observed among the higher vertebrates that bring forth their young alive, and even the abortive beginnings of such a process are regarded as extraordinary phenomena by biologists.

THAT chunks of iron ore are stuffed with steam and blown to pieces in a new metallurgical process which may become a wide-spread and money-saving method of treating ores was reported at the meeting of the American Institute of Mining and Metallurgical Engineers by Mr. R. S. Dean, chief engineer of the metallurgical division of the U. S. Bureau of Mines, and Mr. John Gross, metallurgist of the bureau, who discovered the process. Preliminary investigations have shown that the method requires little expense and labor and they believe that it may work something of a revolution in mining. Zinc and iron ores have been successfully shattered. The pores and crevices of the ore are first impregnated with water, then the ore is heated under pressure until the water turns to steam. When the pressure is suddenly released, the lumps of ore tear apart under the force of the expanding steam just as small grains of wheat can be blown into large fluffy particles.



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SCIENCE NEWS

Science Service, Washington, D. C.

NEUTRONS

THE neutron, the physical concept brought into prominence by research reported by Professor James Chadwick, of the Cavendish Laboratory, Cambridge, England, is a close combination of two other more familiar parts of the atomic structure, the electron and the proton. The electron is the negative particle or unit of matter and electricity, while the proton is the unit of positive charge. The neutron, being a combination, has no charge at all.

Therefore, physicists delving into the constitution of matter have considered that it would be very difficult to prove that it actually exists. The neutron would pass through ordinary matter without having any magnetic or electrical effects, but a theoretical possibility formerly suggested for its physical detection would be through the gravitational effect of the neutron upon passing close to some atomic heart or nucleus.

While the idea of an electron and a proton combining to form a neutral particle that might play a part in the structure of matter is probably some fifty years old, the idea of the neutron was put forward formally as an "attractive speculation" by Drs. R. M. Langer and N. Rosen, of the Massachusetts Institute of Technology, in a communication to *The Physical Review* of the American Physical Society on June 15, 1931. Professor W. Pauli, of the Institute of Technology, at Zurich, Switzerland, also suggested the usefulness of the neutron when he spoke before the American Physical Society, at Pasadena, California, last June. He suggested the neutron might explain some fine structure in the spectra of elements.

The neutron may be the solution of the mystery of the cosmic ray. Since physicists began to study these extremely penetrating radiations from outer space there has been difference of opinion as to whether they are electromagnetic waves like light and x-rays or streams of electrons, the negative particles of electricity. Professor Chadwick's researches just reported from England may give evidence that they are neither, but that they are instead streams of neutrons. This would fit the experimental facts of other investigators here and abroad that show that cosmic rays can not be deflected by magnetic fields as electrons should be, and yet do not wholly fit the character of an electromagnetic vibration.

Neutrons may prove also to be a new building block of the elements. The helium nucleus, also called the alpha particle, is now considered a fundamental brick for element building. It consists of four protons and two electrons and has a positive charge of two. The helium atom is itself built of four hydrogen atoms, which each consist of a proton with an electron revolving about it like a planet around the sun.

American physicists will await with interest Professor Chadwick's scientific report of his experiments. It may prove that the neutron is formed during the artificial

disintegration of matter, such as has been accomplished by Professor W. Bothe, of Giessen, Germany.

NEW PHOTOGRAPHIC PLATES

NEW photographic plates that take pictures in the dark and have to be kept packed in ice until used promise to usher in a new era of photography and spectroscopy. To the Optical Society of America, meeting at Cambridge, Massachusetts, Dr. C. E. Kenneth Mees, of the Eastman Kodak Company, demonstrated the results of using a new dye discovered at his laboratories for sensitizing plates to infra-red radiation, the invisible light that is longer than can be seen by the eye. A photograph of a flatiron taken in the dark with its own heat rays was exhibited.

More important to science was the report of Drs. W. F. Meggers, C. C. Kiess and C. J. Humphreys, of the U. S. Bureau of Standards, who, using the new plates, discovered many new spectroscopic lines of 36 chemical elements. These new "flags" of the elements were found in the region of the spectrum lying between wavelengths of 9,000 and 11,200 Angstrom units. The plates sensitized with the new dye record a wide band of invisible heat "light" from 8,000 to beyond 11,000 Angstroms, with a maximum at 9,600 Angstroms.

Not only do the new infra-red sensitive plates "see" farther into the infra-red than ever before, but they have a speed a hundred to a thousand times that of the best plates that have ever been made before for the infra-red region.

Use of the new plates is expected to extend the knowledge of the elements greatly. Physicists at the Bureau of Standards state that the Eastman Research Laboratories, discovery "is recognized as beginning a new era in infra-red spectroscopy."

The new plates have allowed astronomers to discover iron lines in the stars that are known as B and F stars. It is possible that important new astronomical discoveries will be forthcoming as soon as the new plates are used as ammunition in the large photographic telescopes of America. They may see stellar bodies that human eyes and ordinary photographic plates can not detect.

The name of the new dye used to sensitize the plates is zenocyanine. It is much more sensitive and reveals more of the spectrum than dicyanine, which held first place among infra-red sensitizers for a decade, or neocyanine, which was discovered in 1926. The dye must be synthesized just before use and the plates must be kept in cold storage or packed in ice as just the heat from the sides of an ordinary container at room temperature will fog the plates.

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THE DEAN
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on February 25 by Drs. C. J. Davisson and L. H. Germer, of the Bell Telephone Laboratories, New York.

A stream of electrons moving at high speeds was directed at a nearly glancing angle towards an etched metal surface, and caught on a photographic plate where the diffraction rings formed showed that the electrons behaved like light waves. Previously untried metals and a new method devised by Professor G. P. Thomson, of the Imperial College of Science and Technology in London, were used in the recent experiments. Patterns of about twenty rings were obtained in the new experiments of Drs. Davisson and Germer from the metals gold, tungsten, molybdenum, cobalt, nickel, chromium and platinum. The arrangement of the rings was characteristic of the known structure of the metals.

For some metals, etching with acid or standing in the air caused a change in the pattern. A narrow pencil of light rays directed at a fine grating or a pencil of x-rays hitting a crystal surface produce similar "diffraction" patterns because of their wave-like nature.

BLOCKS OF ATOMS

DR. FRANCIS BITTER, of the Westinghouse Research Laboratories, has established for the first time, through magnetic researches, that the matter that seems to ordinary eyes so solid and unbroken is actually made of blocks, somewhat like a tile floor, each block made of several million atoms. Reporting to the American Physical Society, at Cambridge, Massachusetts, Dr. Bitter described his experiments that upheld the previous theory that contends such block structure in solids exists.

A magnetic powder was suspended by Dr. Bitter in a liquid which was allowed to evaporate on a shiny surface of the metal cobalt. As the liquid evaporated a regular lace-work appearance was produced by the grouping of the particles. As these deposits were arranged in the form of hexagons, Dr. Bitter concluded that the blocks of the metal itself had just this hexagonal arrangement.

Magnetization of the cobalt specimen changed the pattern to a series of not quite parallel lines, showing that the blocks had become differently arranged under the influence of the magnetic force. Irregularities in the pattern were produced, Dr. Bitter believes, by impurities in the metal. This brick or mosaic structure provides the key to some of the most baffling problems about the strength and electrical resistance of solids.

Dr. Bitter's discovery was not accidental but followed logically from a long series of theoretical investigations in which he studied what would be the consequences of such a block structure in solids.

Dr. Bitter is the son of Karl Bitter, internationally famous sculptor.

HOW INFANTILE PARALYSIS ATTACKS ITS VICTIMS

A THEORY of how infantile paralysis attacks its victims has been applied to the disease as it occurs in man by Dr. Harold K. Faber, of the Stanford University

Medical School. This theory is based partly on experimental work by two British investigators, Fairbrother and Hurst.

The germ of the disease, Dr. Faber believes, does not reach the nervous system through the blood or lymphatics, but directly through the nose without any preliminary attack on the rest of the body. Dr. Faber disagrees with other clinical authorities who believe that in this disease there is a preliminary stage when the germ is in the blood or directing its attack on the body generally before spreading to the nervous system where it produces its damaging effects.

Dr. Faber studied the histories of over 100 cases of this disease. He found that the most frequent and characteristic symptoms at the onset, considered by themselves and in their observed combinations, were either obviously of a nervous order or strongly suggestive of nervous disturbance, and none was incompatible with a nervous origin. They were fever; vomiting; drowsiness, restlessness and irritability; headache; pain or excessive sensitiveness; awareness of bodily disturbance or vague symptoms of discomfort.

These same symptoms, together with others showing a spread in the injury to the nerves, are almost equally characteristic of the later stages of the disease, he points out.

Another point supporting his theory is the fact that the permanent damage to the nerves and the resulting paralysis are confined to one side of the body in more than three fourths of the cases. If the germ first invaded the blood stream and then spread to the nerves, the paralysis and nerve damage could be expected to be scattered evenly over both sides of the body.

Furthermore, students of the disease have found it very difficult, almost impossible, to produce infantile paralysis in apes by injecting the virus or germ causing it directly into the veins, while it has been comparatively easy to produce it only by applying the germ directly to nervous tissue through injections into the spinal cord or brain. This is another reason why Dr. Faber thinks the virus must attack the nervous system directly when it produces the disease in man.

THE USE OF FIRES IN PINE FORESTS

SALVATION of the valuable long-leaf pine, which once stretched in virgin stand from Virginia across the South to east Texas, lies in the use of what is commonly regarded as the arch enemy of all timber—fire.

This is a conclusion reached by S. W. Greene, representative of the Bureau of Animal Industry at the Coastal Plains Experiment Station at McNeill, Mississippi.

Fire, Mr. Greene states, burns up the grass which promotes spreading of brown spot disease, Nemesis of the pine seedlings. Fire stops the growth of hardwoods and less desirable species of pine, which suppress the long-leaf variety. Fire cleans out the underbrush and encourages the growth of legumes which enrich the soil and make it better ranging land for cattle and quail.

Mr. Greene advances these arguments, heretical in the

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opinion of many foresters, in a report to the American Forestry Association.

The long-leaf pine, he states, has a peculiar habit of growth. Instead of shooting up a stem as soon as it germinates, it forms a bundle of leaves in the grass and for several years builds a root system and stores reserve food there. If fire causes it to shed its needles, it merely calls on the root food to form a new set, and keeps on growing. Other pines, however, spend their energy the first year in building a stem, and are easy prey of smoke and flame.

Fires, Mr. Greene says, can be used to keep the pine-needles and other light fuel cleaned up and thus prevent the accumulation of a serious fire hazard. But they must be handled wisely, for the process of fighting fire with fire is one to be thoroughly studied.

Mr. Greene's view regarding the use of fire in forest culture will encounter much opposition. The majority of foresters and those unofficially interested in forests believe that fire, no matter how applied, is definitely harmful. For them, there are other and better ways of perpetuating the South's long-leaf pine.

ITEMS

FROM its inexhaustible storehouse of wealth, the sea will in the future supply man with useful substances of all kinds from precious metals to essential elements of diet and common chemicals, H. F. Taylor, of New York, fishing industry executive, predicted before the Franklin Institute. Of the 92 chemical elements, 47 are found in the sea, Mr. Taylor pointed out. They are in solution in water, in tissues in living plants or animals, or in bottom sediments. Few of them are now recovered for use by man. Salt, iodine, bromine, magnesium chloride and magnesium hydroxide are the only substances that are now being taken from the ocean in quantity, it was said, because they can be separated from the water by such crude processes as evaporation and precipitation. Mr. Taylor predicted, however, that research will develop refined methods which will be used to economically recover the more valuable substances.

A NEW stratosphere balloon, to emulate last year's high-altitude flight by Professor August Piccard, is being built at Augsburg to the order of Count Theodor Zichy, a Hungarian nobleman, and Hans Braun, a Vienna engineer. It is to carry a 75-foot parachute to insure safety in landing. A radio sending set is also reported to be part of the equipment.

NEW evidence for the existence in plants of a growth-promoting substance resembling the hormones or ductless gland secretions of animals has been reported to the National Academy of Sciences, through the medium of its *Proceedings*, by H. E. Dölk and K. V. Thimann, of the California Institute of Technology. They grew cultures of a mold in closed glass dishes, in such a way that they could pass a slow continuous stream of sterile culture fluid through them, thus draining off a very weak solution of the growth-promoting stuff as the mold plants gave it off. After concentrating and purifying this, they tested its effects on young oat sprouts. They measured

its strength by the time required for it to cause the sprouts to bend through a given distance, when the substance was applied on only one side of the growing region, causing more rapid growth on that side. They have also begun a chemical study of the substance, testing the effects of various reagents on it. They have demonstrated that the substance itself is an acid.

EIGHT hundred miles of waterway linking rich radium discoveries with civilization are being improved by the Hudson Bay Company in order that valuable ores newly discovered in the Canadian Northwest Territories can be transported, according to Mr. Hugh S. Spence, mining expert for the Canadian Government, who spoke at the meeting of Mining and Metallurgical Engineers. The radium ores are worth \$70,000 a ton at present prices and silver ores found in the same workings assay \$2,000 a ton. Airplanes have been used to carry prospectors and miners back and forth, but it will be more economical to carry the heavy ore by water. Twenty tons of ore were brought out last summer, but the difficulties were great. Most of the improvements are being made on the Great Bear River, the outlet from Great Bear Lake on which are situated the new mines. The Great Bear River leads to the Mackenzie down which some seven thousand tons of freight are carried in the fur steamers each year. One ten-ton scow is the only means of transport at present on Great Bear Lake itself.

THE parent substance of the life-essential, scurvy-preventing vitamin C is none other than the poison narcotine, investigations of Dr. Otto Rygh, his wife, Dr. Aagot Rygh, and Dr. Per Laland at Oslo have shown. Narcotine is one of the alkaloid poisons found in opium and is related to morphine, but in spite of its name does not have any narcotic effect. It is transformed into vitamin C during the ripening of fruits and vegetables. The isolation of vitamin C and discovery of its parent substance came as a result of studies of the occurrence of the vitamin in various fruits and vegetables such as oranges, lemons, tomatoes, white cabbages and potatoes. The Norwegian scientists found that narcotine was present in the unripe fruits but gradually disappeared as the ripening proceeded and the ripe products contained the vitamin but no narcotine. It was found that methylornarcotine, derived from narcotine, could prevent or relieve scurvy.

OIL calmed troubled waters in a very practical way when waves from 50 to 60 feet high in the middle of the Pacific Ocean threatened to bring disaster to the *S. S. Elizabeth Kellogg* on its recent voyage from Manila to San Pedro, Calif., the Hydrographic Office of the U. S. Navy has been informed. The worst seas that Captain Kort, master of the vessel, has seen in his twenty-five years' experience as a captain rolled over the lower decks and finally carried away everything and dented the after steel deckhouse seven inches. Then oil was pumped through sanitary drains on the water. After the oil spread, the combers lost their terrific force and rolled safely under the stern of the vessel instead of breaking over the decks.

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SCIENCE NEWS

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HYDROGEN ATOMS

EXISTENCE of the neutron, reported in experiments at Cambridge, England, will probably make simpler the explanation of the double weight hydrogen atoms that were recently discovered through joint work at Columbia University and the U. S. Bureau of Standards.

This is the opinion of Dr. F. G. Brickwedde, physicist at the U. S. Bureau of Standards, and one of those who discovered the novel hydrogen atoms of isotope or mass number two.

Ordinary hydrogen is known to be a nucleus of a single proton or positive charge of electricity surrounded by an electron or negative charge of electricity. The neutron is postulated to have the same atomic ingredients, but the proton and electron are so closely associated in forming the neutron that it is left with no electric charge.

Dr. Brickwedde's suggestion is that the nucleus of the heavy weight hydrogen, with approximately twice the atomic weight of ordinary hydrogen, has its heart or nucleus made up of one neutron and one proton, with a whirling orbital electron on the outside that makes the double weight hydrogen isotope neutral like the ordinary hydrogen atom.

If neutrons, as a sort of elementary element without charge, are floating about like a gas, it would be far simpler for a proton to meet up with a neutron and combine to form a nucleus of hydrogen isotope two than for two protons and one electron to get together to form the heart of heavy weight hydrogen atom.

Formation of the heart of the heavy hydrogen atom from a neutron and a proton in this way may therefore prove to be a first step in element building.

THE DEFLECTION OF LIGHT

ADDITIONAL photographs of the stars visible close to the sun at the time of a total solar eclipse are required as a further check on the Einstein theory of relativity.

The making of such observations was urged at a recent meeting of the Royal Astronomical Society by Sir Frank Dyson, Astronomer Royal, and Sir Arthur Eddington, of Cambridge University, following a paper presented by Dr. Erwin Freundlich, director of the Einstein Tower at the Potsdam Observatory, Germany. A full report of the meeting has appeared in *The Observatory*, a British astronomical monthly.

According to Einstein's theory as announced in 1915, a beam of light from a distant star will be pulled slightly inwards as it grazes a massive body like the sun. A similar deflection, but considerably smaller, was predicted on the basis of Newton's theory, previously accepted. Stars close to the sun can not ordinarily be photographed because of the great glare, but at eclipse time, when the moon covers the solar disc, they are visible. They were photographed at the eclipse visible in Principe, West Africa, in 1919, by Sir Arthur Edding-

ton, of Cambridge, as well as by other astronomers at later eclipses.

All results so far announced, except those from observations by Dr. Freundlich at the eclipse of 1929 in Asia, agree closely with Einstein's prediction that a beam just grazing the sun's surface would be deflected 1.75 seconds of arc. This minute amount is about a thousandth part of the diameter of the full moon. The eclipse of next August will not be suitable for these observations, for there will be no bright stars near the sun.

With the photographs made in 1929, Dr. Freundlich took special pains to check any distortion of the plates. He used two cameras, and at the same time that he photographed the eclipsed sun and the surrounding stars he photographed on another plate a field of stars about 25 degrees away. Some months later both fields of stars, then in the night sky, were rephotographed with the same cameras and the results compared.

Dr. Freundlich pointed out that most of the stars in the eclipse field were on one side of the sun. They should be equally distributed around it for the best results. However, his calculations show the deflection to have been 2.16 seconds, instead of 1.75. He then checked the work of the Lick Observatory party in 1922 at an eclipse in Australia and, by using corrections which he said they neglected, obtained 2.27 seconds for their result.

In commenting on Dr. Freundlich's remarks, both Sir Frank Dyson and Sir Arthur Eddington expressed skepticism, though both urged the need of more observations. Sir Frank called attention to the fact that none of the observations yet made were without drawbacks and that the stars observed by Dr. Freundlich were not uniformly distributed.

COLORED ARTIFICIAL STONE

MAKING stone take on the delicate colors of the beautiful luna moth is one evidence of the efforts being expended to gain relief in architecture from the monotony of a machine age. That is what Professor Fred R. Lear, professor of architectural design at Syracuse University, has told the American Concrete Institute.

Professor Lear explained how he reproduced the varied shadings of the insect with a mixture of cement, crushed stone and color pigments. It is through this medium of synthetic stone, he stated, that the demand for appropriate color in home, school and skyscraper is being satisfied.

Artificial stone, he said, has been known for some time, but only recently have colors in stone been appreciated for their intrinsic value, and never before has mass production of color in building enterprise been so keenly taken into account.

Metallic oxides are largely used to achieve the desired intensity and shading of the color in the laboratory material. Unlike natural stone, all the hues of the rainbow can be duplicated.

The stone is molded into any necessary shape without the loss from chipping which is characteristic of ordinary stone work. The cast stone can be used alone or in combination with other building materials such as brick. In this case it not only harmonizes with the brick color, but also serves to bring the color out fully.

Cast stone is made with material like crushed marble, or granite, as a base according to the quality desired in the resulting product. It is as durable as any natural stone of its price level and retains its color much longer. In the early days of cast stone, imitation of natural products was the chief aim. While it is still possible to duplicate these stones, the molded material is now a distinct, individual creation.

HELIUM PURIFICATION

A NEW plant for the purification of the rare gas helium, which is used in Navy airships, is being planned by the U. S. Navy Department.

The new plant, for which bids will be opened on April 6, will be built at the Navy's new airship base at Sunnyvale, Calif. It is to have two units, each of which is to be a complete and self-contained outfit for the repurification of helium. Each unit will have a capacity of 15,000 cubic feet of impure helium per hour.

The Navy finds it necessary to maintain such a repurification plant because no fabric has yet been found which will completely exclude air from the airship cells containing the precious helium. The cell walls are now made of several layers of latex with a filler of gelatine between each two layers. This material contains no perceptible pores through which air could leak, but minute quantities of air do find their way through, perhaps by mixing with the fabric coating and becoming free again on the other side. The minute amounts of air thus admitted are very important, however, for impurities amounting to only one per cent. in the helium make a difference of almost two tons in the lifting power of the airship.

A novel feature in the specifications of the new plant as issued to firms interested in bidding is the requirement that carbon dioxide shall be removed from the helium through the use of lithium hydroxide, a chemical used in alkaline storage batteries. Lithium hydroxide has never before been used commercially for this purpose. Methods used formerly for the removal of carbon dioxide made use of sodium hydroxide. The building and operation of the plant will be under the direction of the Navy.

The specifications require that the helium shall be made at least 98.5 per cent. pure. The Navy has recently been able to attain a purity higher than 99 per cent. by a new process, whereas previously 98 per cent. had been considered satisfactory.

PLANTS TO DETECT TOXIC GASES

TOMATO plants are being used to detect illuminating gas leaks and the presence of other toxic gases in laboratories and greenhouses at Yale University, according to Professor Carl G. Deuber, of the department of botany.

These plants are being used in the same way that canaries are used in mines.

In the presence of the merest traces of toxic gases the younger leaf-stems of the tomato plant grow downward, due to a more rapid growth of the cells on their upper sides. Professor Deuber found that this is an absolutely reliable test for illuminating gas leaks.

The effect of various lights on plant growth is being investigated in the Yale laboratories. "Since daylight is a complex of all colors of the solar spectrum, experiments with different qualities of light are being conducted," Professor Deuber reports. "By means of special boxes fitted with spectral glasses that transmit only certain portions of the solar spectrum, we are able to note the influence of red light, orange light, blue light, etc.

"In addition to the intensity and quality of light that is known to influence plant growth, it is also realized that the photo-period, i.e., the length of exposure of a plant to light each day, may determine whether that plant will continue developing leaves indefinitely or come into bloom, even though it is but a few inches high.

"Light is but one factor affecting the growth of plants. Soil moisture, supply and kind of mineral nutrients, high and low temperatures, the presence of toxic agents in the soil or air, as well as many other factors, exert marked effects on plants and are subject to experiment in a greenhouse. It makes a surprising difference in plant growth when too little or too much moisture is present in the soil. The deficiency of any one of the necessary mineral nutrients for plant growth can be readily followed with water or sand cultures in which the root environment can be accurately controlled."

FOREST FIRES

THE forest fire season, which begins in the East during the latter part of this month, is expected to be much less disastrous than that of memorable 1931, according to Mr. Roy Headley, of the U. S. Forest Service, in a statement made to Science Service. Despite the alarm occasioned by the burning in the Florida Everglades, there are no fires of any consequence in national forests now.

Rain and snow have fallen heavily throughout the West this winter, breaking the ten-year precipitation record for southern California. As a result ground water is being replenished in national forest states and the opening of the western fire season will probably be delayed until the middle of June. Last spring, the excessive drought and the high, parching winds made conditions in the Northwest acute by April.

The cycle of declining precipitation, which has extended over the last dozen years in the West, is believed to be at an end, and normal weather is hoped for, Mr. Headley stated. For the last six or eight years the increased use of the national forests and uncommonly dry weather have made the job of the forest service more difficult. Improvement in personnel and equipment has made the battle against fire about evenly matched. Now, with a favorable smile from the weather, the Forest

Service should have the upper hand in fire prevention and spectacular results during the next two or three years can be expected.

The problem in north Idaho, however, will be a severe one to cope with. Shutting down of the mills because of the economic depression will bring the specter of incendiarism more into evidence. Men out of work, Mr. Headley said, will deliberately start fires in hopes of getting a job fighting them.

Likewise in this area and in western Montana, there will be 1,200 fewer men in the woods during the three months of the fire season. Decreased Federal appropriations have stopped the work on roads and trails in the national forests and the workmen, who are trained to fight fire, will consequently be absent.

RADIO SETS IN THE FOREST SERVICE

FIRE fighters in national forests will go into the field this summer to try out for the first time radio sets they can carry on their backs. Each set, consisting of both transmitting and receiving units, weighs but ten pounds, and will enable the forest personnel to keep in constant touch by signal code.

The approaching fire season will also see the introduction of the improved radio outfit which permits transmission not only of code but of voice as well. These sets, greatly simplified and extremely reliable, weigh but twenty-five pounds and can be transported on horse-back. If funds are available several hundred of them will be purchased and put into use.

The 25-pound set is a refinement of the 78-pound outfit experimented with in the Columbia National Forest during the summer of 1930. Strenuous tests, Forest Service officials said, have shown the lighter set to be "almost too good to be true." It permits the broadcast of the voice up to a distance of a hundred miles.

The new radio sets will find wide usage in fire fighting activity. Whenever a member of the forest personnel is away from a telephone he can make his report and receive orders by radio. This is frequently the case in many areas during acute periods of fire fighting. Both the ten- and twenty-five-pound sets will be used under these conditions, while heavier sets are also slated for use on forest service boats in Alaska to make possible communication with points on shore.

Wide-spread use of the radio sets is necessarily dependent upon financial considerations. The new instruments can not be counted on to put an end to forest fires. Fire control, however, will undoubtedly be greatly facilitated.

ITEMS

ULTRA-VIOLET light, already of proved worth as a detective in searching out hidden writing and exposing bogus art, now protects dealers in honey against adulterated sweets. Two Danish investigators, S. A. Schon and J. Abildgaard, have found that genuine honey absorbs ultra-violet radiation at a fairly even rate, but artificial honey has a pronounced "absorption band" at one spot—that is, one place in the spectrum of the radia-

tion passing through it where no rays come out. This absorption band is due to the presence of a substance known as hydroxy-methyl-furfural, characteristic of artificial honey but absent from the genuine product. By the study of this absorption band it is even possible to obtain a quantitative estimate of the amount of adulterant used in a suspected sample.

A NEW type of filter, with interstices covered with silver, has been tested at the Pasteur Institute, of Paris, by Dr. Nicolas Metalnikov, and found to confer upon the filtered water the power to destroy living bacteria. The filter is made by adding chloride of silver to the moulding clay and baking at a high temperature of 2,200 degrees Fahrenheit. According to its inventor, Georges Lakhovsky, the water which passes through the filter does not contain any silver and is perfectly harmless; yet it retains for several days the power to destroy resistant bacteria like the common *Bacillus coli* and *Bacillus typhosus*, which causes typhoid fever. The bactericidal power of the water that has passed through the silvered filter is claimed to be entirely due to the ionization of the water, and it disappears if the water is boiled for a few minutes. During its passage through the filter the water becomes slightly alkaline.

RADIO listeners near high-voltage power lines should enjoy clearer reception as the result of researches of Professor F. O. McMillan, of Oregon State College, who has proved that the leakage of current across insulators is a source of troublesome noise in nearby receiving sets and has found ways of overcoming this nuisance. These leaking currents set up oscillations of radio frequency, Professor McMillan explained in a report to the American Institute of Electrical Engineers. In tests which he conducted in a darkened room, every time a leakage from a high voltage line was observed, noise occurred in a radio set. The noise was often heard before the leakage became visible. The leakage, and hence the interference, can be done away with, it was pointed out, by designing the insulators so that air near their surfaces is not overstressed electrically. The stresses might also be equalized by properly coating portions of the insulator with a conducting material.

MILK sugar, or lactose, helps to build up a strong, bony structure in the growing chick, Dr. E. B. Hart and his associates at the University of Wisconsin have found. Lactose is an important part of the milk produced by animals, making up nearly two thirds of all the solids in human milk and from four fifths to one half of those in whole cow's milk. In skim milk or butter-milk, lactose makes up half of the total solids. The Wisconsin investigators found that lactose fed as from 10 to 40 per cent. of the chick ration gave a partial control of rickets and was half as effective as artificial sunlight in producing strong bones. The milk sugar also helped the chicks to make better use of the lime in their feed.

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SCIENCE NEWS

Science Service, Washington, D. C.

ADVANCES IN THE STUDY OF TERRESTRIAL MAGNETISM

A BETTER understanding of events deep within the earth has been made possible during the past few years through research by scientific men who know how to read the language of the subterranean happenings as written in the varying of the compass needle from true north, Mr. John A. Fleming, acting director of the Department of Terrestrial Magnetism of the Carnegie Institution of Washington, stated in a lecture before the institution.

Mr. Fleming presented conclusions reached after careful study of all data collected during past centuries including information taken in recent years from more than 10,000 stations established in different parts of the world by the Carnegie Institution. Thus the most complete picture possible of the long period or secular variation of the earth's magnetism is obtained.

"The relation of large and rapidly changing rates of change of the intensity and direction of the magnetic field to the surface structure of the earth can scarcely be accidental," according to Mr. Fleming. "It is natural to expect that there is a causal relationship existing between crustal and subcrustal movements and these magnetic manifestations. Perhaps there are changing mechanical stresses, or possibly a changing distribution of internal heat, which in turn affects the direction or magnitude of subterranean electric currents."

The great secular variations, which over a period of several hundred years cause the compass needle to change its direction by as much as 15 to 20 degrees at some places on the earth, are now better understood, following detailed mathematical analyses of data for periods centering around 1842, 1882 and 1922 by investigators at the Department of Terrestrial Magnetism. Thus it is known that the main cause of the secular variation arises from a system of forces embedded in the earth. This variation is caused not only by a change in the direction of magnetization, but also by a change in its intensity.

Magnetic force has been decreasing more rapidly in the southern, or water hemisphere, than in the northern, or land hemisphere. The average equivalent intensity of magnetization over land areas is somewhat larger than that over ocean areas.

By studying very small wobbles of the compass needle important knowledge may be gathered about the condition of the earth's upper atmosphere and activity on the surface of the sun itself. Mr. Fleming said that the behavior of the compass needle offers the best present-day means of probing happenings a few hundred miles above the earth as well as 92,000,000 miles away.

Though the solar and lunar variations which he suggests for use in studying sun activity and the upper atmosphere are extremely small, they constitute a desirable form of observation because they are repeated daily and because they can be well isolated from other magnetic changes. To illustrate the size of these diurnal

variations, Mr. Fleming assumed the existence of a two-mile-long compass needle in Washington. During daylight on a magnetically quiet day the end of this needle would move only ten feet.

RETURN OF THE GRIGG COMET

THE Grigg comet, a periodic visitor to the sun, has been rediscovered by Dr. George Van Biesbroeck of the Yerkes Observatory.

It is a faint object of sixteenth magnitude in the constellation of Orion, the group of stars that can be seen in the southwestern evening skies. The Grigg comet, however, can be seen only with the largest telescopes. The location of the Grigg comet when discovered on Saturday evening (March 5) was right ascension 5 hours 31 minutes 49.3 seconds and declination north 5 degrees 3 minutes. No tail was reported.

Astronomers throughout the world were notified of the reappearance of the comet by means of astronomical telegrams sent through Harvard College Observatory.

Dr. Van Biesbroeck was also the first to sight this periodic comet when it made its last return in 1927. The astronomer Grigg, whose name the comet bears, first discovered it in 1902. Then the comet was missed on its subsequent returns until 1922 when Mr. J. F. Skjellerup, an Australian astronomer, found it again. The comet is therefore sometimes called the Grigg-Skjellerup comet.

The Grigg-Skjellerup comet is one of nine periodic cometary visitors to this region of the solar system that may be expected this year. Those most likely to be observed are: Tempel's comet, Neujmin's second comet, Kopff's comet, Borelly's comet, Brooks's second comet, and Faye's comet.

On its previous visits the Grigg-Skjellerup comet has not been seen with the naked eye, and it is therefore very unlikely that it will be easily seen by the public.

THE ORIGIN OF A SUBMARINE GORGE

How the "new" submarine canyon in the sea floor off Georges Bank and the New England Coast made its sudden debut by acting as a huge dump wagon, sliding its load of Ice-age debris out when it was jarred by an earthquake, is told by Professor Francis Parker Shepard, of the University of Illinois.

Corsair Gorge is the name of the new feature on oceanographic maps of the North Atlantic. It apparently wasn't there before the earthquake of November, 1929, which wrecked most of the transatlantic cables off the Grand Banks, 600 miles to the north. It was there by Christmas of the same year, when it was first detected by the sounding apparatus of the steamer *Transylvania*. Its presence was confirmed through a careful survey by the U. S. Coast and Geodetic Survey.

Corsair Gorge stood as a challenge and a mystery to oceanographers. It did not appear to be the result of a sudden drop in the ocean floor. Neither did it seem to be a drowned river valley.

Professor Shepard disposes of its newness by advancing

the hypothesis that it is not new at all. He holds that the gorge originated as a deep cut, excavated by a river when the land was much higher than at present, probably millions of years ago. Then subsidence of the land decreased the valley. Later, during the glacial period when the sea level was hundreds of feet lower than now, great ice sheets spread out on to Georges Bank. Débris carried from the terminus of the ice by a network of streams probably filled the gorge till it lost its topographic expression.

So it stood for many thousands of years, perhaps until the recent earthquake gave it a kick. Then, like the load of a dump-wagon jolted from underneath, the accumulated débris slowly slid out of the trough, leaving it empty and ready for discovery by the first passing steamer with echo-sounding apparatus at work.

The movement was so slow that surface waves violent enough to betray the disturbance were not formed. Soundings of the ocean bottom at the mouth of the gorge reveal a zone of hummocks formed of the displaced sediments, further evidence of the great submarine landslide.

THE CAUSES AND EFFECTS OF ARTERIO-SCLEROSIS

HARDENING of the arteries, called arteriosclerosis by medical men, is really not a disease but a device for mechanical protection of the arteries. It is not a condition due to old age nor is it necessarily incurable.

This unorthodox theory together with a new method of treating the condition has been proposed by Dr. J. Plesch, professor of internal medicine in the University of Berlin. In his report to the London *Lancet*, Dr. Plesch described one feature of his treatment for the condition as a "Biblical diet" because, like certain fasting or dietary rituals of various religions, it introduces a "dietary day" once a week and a three or four week period of dieting once a year.

His method of treatment consists in first removing the causes so far as possible. Next efforts are directed toward relieving the overtaxed circulation. This should not be done, however, by the direct use of drugs which lower blood pressure through paralyzing the blood vessels, as these do more harm than good, Dr. Plesch thinks. Instead he prescribes frequent rests in the recumbent position during the treatment. Finally there is the dietary regimen which consists chiefly in living on a diet free from nitrogen (protein) and salt (sodium chloride) for one day a week regularly and for every day during a three or four week period once a year. Fresh air and complete mental relaxation are other features of Dr. Plesch's treatment.

"Arteriosclerosis is a disease that sets in at every age, that can be arrested and that can be cured in the early stages and beneficially influenced in the later stages; it is not an ailment of old age which must of necessity be progressive and incurable," in the opinion of Dr. Plesch. "It is often found in youthful people and often absent in the aged; and when it does make its appearance in old age it rarely has any serious consequences."

Arteriosclerosis is only one feature of a constitutional

disease resulting in a lack of tone which chiefly affects the smooth muscles of the blood vessels, Dr. Plesch thinks. The actual hardening of the arteries he takes to be a protective process rather than a disease.

"The primary cause of arteriosclerosis is the weakening both of the muscular and of the elastic elements of the walls of the blood vessels." If the weakened walls of the blood vessels are not able to offer enough resistance to the blood pressure they become stretched and dilated, he explained. At points especially exposed to high blood pressures, changes occur which are solely for the purpose of increasing the resistance of the walls. These changes, among them the hardening which gives the condition its popular name and which consists of deposits of lime, offer protection against breaks in the artery walls.

Dr. Plesch called attention to the fact that the examination after death of healthy young soldiers who fell during the war revealed a surprising prevalence of the condition. One careful investigator was able to prove that almost half the soldiers between the ages of 21 and 30, and well over half of those between the ages of 31 and 40 years showed hardening of their arteries, chiefly of the arteries of the heart.

CHILDREN'S DEATHS IN 1931

OFFICERS of the Metropolitan Life Insurance Company have found from a statistical study of their records that in spite of the continuing business depression and increasing unemployment, the death rate for children between one and fourteen years of age among families of insured wage earners was lower during 1931 than 1930. In 1931 this death rate was 2.65 per 1,000, while in 1930 it was 2.70 per 1,000. During the period from 1911 to 1915 it was 6.14 per 1,000.

The improvement is especially gratifying considering the changes in family economy which took place as a result of increasing unemployment during 1931. Much of the improvement in child mortality in 1931, as compared with the figures for 1930 and 1911-1915, can be ascribed to the cumulative effect of twenty years of work for child health by the public and private health promotion agencies of the country.

Part of the excellent record of the year 1931, itself, resulted from the continuation in that year, under most trying circumstances, of the health services established on the patterns laid down by the pioneers of child health conservation.

There was a greater decline in the death rate for children from one to four years than for the older children. This is considered a reflection of the decline in diphtheria mortality and in deaths from the other three important diseases affecting this age group, measles, scarlet fever and whooping cough. The whooping cough death rate was lower in 1931 than at any time on record. The death rate for diarrhea and enteritis, another important cause of death among small children, was at the lowest point since 1911 and the tuberculosis death rate for children of one to fourteen years also reached a new low point.

The death rate for white girls was lower than that for white boys or for negro boys and girls, but the death rate for negro girls showed the biggest drop between 1930 and 1931. The death rate for negro boys on the other hand showed a slight increase over the figure for 1930. The death rates by sex and race for 1931 were: white boys, 2.73 per 1,000; white girls, 2.23 per 1,000; negro boys, 4.73 per 1,000; negro girls, 4.02 per 1,000.

ADVANCES IN TELEVISION

TELEVISION to be shown on a large screen in the theater is a step nearer reality following the invention in the laboratories of C. Francis Jenkins in Washington of a new type of projector for the television receiving set.

In the new apparatus a fixed lantern slide on which the objects move instead of being stationary as they are on common still slides takes the place of the flying light-spot system of reproducing the picture. This electrical rather than photographic scanning is accomplished by the substitution of a transparent scanning disc which contains wires running out radially from its center like the spokes of a wheel for the common metal disc containing a ring of pin holes near its edge, it is explained in an article by Mr. Jenkins in *The Yale Scientific Magazine*.

In commenting on this article to a representative of Science Service the inventor said that the new method puts 3,600 times more light on the screen than the old pin-hole scanning system. Light to the screen is never cut off except by images of the objects and these images remain on the screen all the time. Never is the screen, or any part of it, blank, as is the case even in motion picture projection for about one third of the time.

The arrangement of apparatus with which Mr. Jenkins has been able to accomplish in the laboratory what has been impossible even with well-developed motion picture projection is very simple. Instead of being vertical, the transparent scanning disc is flat, and immediately beneath its wire spokes, which end where the usual metal disc would have pinholes, there is a glass plate containing a thin film of an acid. The wires and the acid are subject to voltage which is controlled by in-coming television signals.

A high voltage will cause sparks to jump from the ends of the wires to the acid. At low voltages there will be no spark. And each spark, Mr. Jenkins said, decomposes the acid and forms an air bubble in it. The bubble causes a dark spot to appear on the screen, but it quickly rises to the surface and breaks before another and slightly different image is formed in about one fifteenth of a second.

"The projected picture on the screen is, therefore," Mr. Jenkins explained, "exactly like the usual lantern slide picture except that it has motion; or like a motion picture except that it is made up of changing picture elements instead of changing picture frames on a film. Incidentally, the elementary picture dots are so blended that they are as inconspicuous on the theater screen as are the picture dots of a newspaper illustration."

Mr. Jenkins believes that this system will ultimately come into use for both theater and home television projecting. It is still in the laboratory stage of development.

ITEMS

SHOTGUN shells will be saviors as well as destroyers of game, if the congress passes a new federal tax of one cent each, proposed in a bill which will be introduced within a few days, with the backing of the American Game Conference. The bill will provide that all the money thus collected is to be used as follows: Not to exceed five per cent. of the total for federal administration, research and enforcement; 55 per cent. of the balance to be allotted to the game departments of the various states, based on the number of hunting licenses issued, for the increase of game and waterfowl. The remaining 45 per cent. will be expended by the federal government for the increase of waterfowl through acquisition or control, especially of breeding areas and also of additional refuge and concentration areas wherever they exist or can be restored.

WHETHER you get bitten by the harmless though annoying ordinary mosquito or by the malaria-bearing *Anopheles* depends in part on the "micro-climate"—that is, on small local variations in air moisture and temperature. This is indicated by researches of Professor Erich Martini and Ernst Teubner, of the University of Hamburg, which have been announced in the German scientific journal *Forschungen und Fortschritte*. The two German investigators placed mosquitoes of three species, an ordinary European species, a malaria carrier and a yellow-fever carrier, in specially constructed apparatus in which temperature, air moisture and other conditions could be closely controlled. They found that the common species and the yellow-fever carrier were favored by a high humidity, whereas the malaria carrier preferred a drier atmosphere.

WALKING-STICK insects, ordinarily so little abundant as to be a biological curiosity, will probably be a serious forest pest in some parts of Michigan during the coming summer. Their eggs are now lying on the forest floor in these threatened areas, in numbers ranging from thirty to more than a hundred per square foot, according to a report by Prof. Samuel A. Graham, of the University of Michigan. When they hatch into leaf-eating insects with voracious appetites, as bad as those of their relatives the grasshoppers, the consequences of their activities among the trees may well be imagined. There is one curious thing about the walking-stick's life cycle that may mean the salvation of the Michigan forests. In the oak forests of north central Michigan, the walking-stick eggs do not hatch the spring following their deposition, but lie over for two winters and a summer before they finally hatch.

THE mechanical brains and fingers of the dial telephone system have reduced the number of jobs for telephone operators in the United States by more than 69,000. This is the estimate reported by the U. S. Bureau of Labor Statistics, which has surveyed the progress of the dial telephone and its industrial effects. Complete conversion to the dial system means an average displacement of about two thirds of the operators. In 1921, less than three per cent. of the telephones in the United States were of the dial type. By the end of 1930, very nearly one third of the phones were dial equipped.

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EMBRYOLOGY OF THE MONKEY

THE establishment of a monkey colony in which investigators can study every stage in the development of the animal from the formation of the egg to the birth of the baby monkey has opened a new era in the science of embryology, said Dr. George L. Streeter, of the department of embryology of the Carnegie Institution of Washington, who addressed the opening session of the meeting of the American Association of Physical Anthropologists meeting in Washington on March 19.

From his study of these monkeys, Dr. Streeter found that the maternal body prepares a special place for the fertilized egg to attach itself where the embryo may subsequently obtain nourishment and dispose of its waste products.

This discovery clears up a point which has never been exactly understood before this, either in the case of monkeys or of human beings. It was known that, once the egg was attached to the maternal tissues, the growing embryo was able to get nourishment from them, but no one knew whether the arrangements for the exchange of food and waste products were made entirely by the new little organism or by its parent. Now Dr. Streeter has found that there is preparation on both sides.

He was able to make this discovery as a result of earlier studies on monkeys by Dr. Carl G. Hartman, of the Carnegie Institution. Because monkeys are so small, Dr. Hartman can tell by manual examination just when the egg leaves the monkey's ovary and when it reaches the womb. He knows at just what stage the egg becomes fertilized. By applying this knowledge, Dr. Streeter made his discovery that the maternal tissues begin preparations for the fertilized egg before it attaches itself to them. These preparations consist in forming a marshy place on the interior surface of the uterus or womb. Into this marsh-like tissue, which is kept bathed in blood, the developing embryo shoots little stems called villi, which are filled with blood vessels. The blood in these vessels never mixes with the maternal blood, but nourishment and waste materials are exchanged between them by means of gases and soluble material.

Study of this process of attachment of the fertilized egg to the maternal tissues and the maternal preparations for it may shed light on the causes of sterility, of abnormal developments resulting in monsters and of abortions. The discovery rests not only on Dr. Hartman's work with monkey eggs, but on the skill in handling the tiny eggs and embryos developed by Dr. Chester H. Heuser, of the Carnegie Institution.

DENTAL DECAY

VIVID proof that the modern diet of American civilization causes dental decay was presented before the meeting of the American Association of Physical Anthropologists. Two scientists of the National Museum staff told how they have systematically counted carious teeth

in hundreds of jawbones of prehistoric Eskimos and in the mouths of living Eskimos in Alaska.

The ancient Eskimos were meat-eaters, living chiefly on walrus, seal and fish, with only a little vegetable food. In 800 jawbones of these prehistoric people, Mr. M. S. Goldstein found only 6.5 per cent. with defective lower molars. He selected these molars to count because they are the first teeth of the jaw to succumb to decay. Most of the diseased spots were no more than pinhead size, he stated. Mr. Henry B. Collins, Jr., reported that, on examining the teeth of 296 living Eskimos, he found 26 per cent. of them with more or less dental decay.

"The significant fact," Mr. Collins explained, "is that in remote, barren regions of Alaska to-day where the Eskimos are poverty-stricken, they still live in the old-fashioned way as seal hunters and fishermen. And these living Eskimos practically do not know what toothache is like. But Eskimos living in proximity to white settlements show a much higher incidence of dental decay. At Nome, for instance, we find more than half the natives with carious teeth. In the teeth of those Eskimos who supplement their native sea food diet to a greater or less extent with food that the white men eat, dental decay is prevalent and is directly proportionate to the extent that the diet has been altered."

In evidence that food is responsible for dental troubles of the modern Eskimos, Mr. Collins cited the case of two brothers. One, who lived all his life on King Island, where native diet was eaten, had perfect teeth. The other brother, who had been brought up at Nome, had the majority of his teeth in a decaying state, it was found.

"There is evidence that meat-eating races generally have sound teeth, while grain-eating races are much more affected by tooth decay," said Mr. Collins. "Indian tribes who lived along the sea coasts of America left great mounds of shells showing how much sea food they ate. These tribes had almost perfect teeth. The buffalo-hunting Indians of the Plains had fine teeth. On the other hand, the Pueblos of the Southwest, both ancient and modern, and other agricultural tribes of the United States have poor teeth. These Indian farmers lived mainly on grain and vegetable foods."

THE STUDY OF TUMORS IN CHICKENS

SCIENTISTS who have been studying chicken tumors in the hope of throwing light on the problem of cancer in man have for the first time been able to destroy the activity of one of the chicken tumor-producing agents by means of dyes, according to a report by Dr. Margaret Reed Lewis and Mr. Warren Reed Lewis, of the Carnegie Laboratory of Embryology of the Johns Hopkins Medical School, to the *American Journal of Cancer*.

Dyes are now used to kill certain disease-causing organisms, such as the streptococci, and recently dyes have been tried in the treatment of cancer, although unsuccessfully. The Baltimore investigators wondered what

the effect of dyes would be on chicken tumors, which are cancer-like growths caused by an agent called a filterable virus because it is so small that it will pass through the pores of the finest filters. Viruses have been the subject of intense investigation in recent years, but so far it has been almost impossible to destroy the activity of any virus by a dye, as can be done for larger, microscopic organisms. It is not known whether the virus is a living organism or a chemical substance.

The Lewises, a mother and son, extracted the virus from one of these chicken tumors so that they could work with it in a test tube. They combined it with 80 different dyes. After being mixed with the dye, the virus was injected into the chicken to see if it could still produce a tumor. Two of the 80 dyes destroyed the tumor-producing activity of the virus. However, the investigators pointed out that the activity was destroyed in the test tube by an amount of dye which would be impractical to inject directly into the animal in the hope of destroying the tumor-virus in its body.

They consider 80 dyes a small number to have investigated. They feel from the results of their study that when a larger number of dyes are investigated, it may be possible to find more than two which can prevent the growth of tumors, even when used in more dilute concentrations. Experiments on injecting the dye directly into the chickens suffering from this type of tumor are now being planned.

The world of science is already familiar with the studies of cell growth and cancer on which Dr. Margaret Reed Lewis has collaborated with her husband, Dr. Warren H. Lewis, and it is interesting to note that in this latest investigation she had the assistance of another member of her family, her son, Warren Reed Lewis, now a medical student.

COSMIC RIDDLES

HOPE that "the solution for the great cosmic riddles of the world" will be found by continued careful study of such seemingly unrelated phenomena as spots on the sun, electrified atmosphere miles above the earth, radio echoes and electricity and magnetism in and around the earth, was expressed by Dr. Arthur E. Kennelly, professor emeritus of electrical engineering of Harvard University and the Massachusetts Institute of Technology, lecturing at the Carnegie Institution of Washington.

Dr. Kennelly's name is linked with that of the English physicist, Oliver Heaviside, in the discovery of one of the phenomena in which he thinks the solution to the great riddles lies. It is the Kennelly-Heaviside layer of ionized, or electrified, atmosphere.

"It is found from numerous records," Dr. Kennelly said, "that the apparent height of the ionized layer is related to the strength of long-distance radio signals, such as those coming over the Atlantic Ocean. Also the strength of received radio signals is found to be related to the earth's magnetic activity, as recorded photographically in a number of terrestrial magnetic observatories. This magnetic activity, in turn, is related to the conditions at the surface of the sun as revealed by sun-spots. Thus, radio reception, ionized-layer height,

terrestrial magnetic activity and the 11-year sun-spot cycle are all correlated. Changes in one accompany changes in the others.

"The reasons for the interconnection of these widely different phenomena can be guessed at to some extent," he continued, "but only, as yet, in a tentative way. The spots on the surface of the sun are found to be associated with outpouring of ultra-violet light, and this may change the depth and density of the ionized layer in the atmosphere. This can affect radio signals, and somehow affects the earth's magnetism.

"Why the sun should have acquired the habit of an eruptive cycle of about eleven years is still a mystery. There may be cosmic influences at work more remote than the sun."

EARTH TREMORS CAUSED BY A BLAST

THE biggest shot ever fired intentionally—215 tons of dynamite and other high explosives set off in one enormous blast in a limestone quarry near Manistique, Michigan—registered itself as an earthquake on seismograph instruments at points as remote as Buffalo, N. Y., Madison, Wisconsin, and Washington, D. C. Timed at their starting-point on an accurate chronograph brought into agreement with radio signals from the U. S. Naval Observatory, the waves were picked up as they swayed the sensitive pendulums of seismographs at several observatories. The time at Manistique was clocked by Mr. E. J. Brown, of the U. S. Coast and Geodetic Survey.

The Reverend John P. Delaney, in charge of the seismograph station at Canisius College in Buffalo, wired Science Service that an earthquake train lasting ten seconds recorded itself on his instruments three minutes and fifty-six seconds after the blast was detonated in Manistique, at two minutes after 3 P. M., central standard time. The waves apparently traveled along the surface of the earth's crust. Since Buffalo is approximately 400 miles east of Manistique, this means that the waves moved at a rate of about a hundred miles a minute.

From the seismological station of the University of Wisconsin came the report of a clear record of waves of small amplitude, the first arriving two minutes and three seconds after the firing of the blast. Madison is about 300 miles west of Manistique, so that again the waves are shown to be moving at a high rate, this time approximately two miles a second.

The sensitive vertical Galitzin instrument at Georgetown University, Washington, D. C., recorded the arrival of the first wave five minutes and three seconds after the moment of firing in Manistique. Washington is at a distance of about 600 miles from the scene of the great explosion, so that the waves either traveled faster along the surface, or else took a short cut through the deeper rocks of the earth to make this record. The Georgetown instruments have, so far as is known at present, set a record for distance in perceiving the effects of an explosion.

IMPROVEMENTS IN STEREOTYPING

THE speed and economy of mass production newspaper processes can now be applied to the making of high-

grade printing plates, it became known at the Third Conference of Technical Experts in the Printing Industry held in Washington on March 15 under the auspices of the American Society of Mechanical Engineers.

Using the simple paper matrices of stereotyping, Europeans have for years been making plates of as high quality as those produced in America by more expensive electroplating processes, it was said. A committee investigated the foreign methods and found that they could not be readily applied in this country. Speed, a necessity in the American industry, means nothing to the European, and secret formulae, known only to individual foremen, are largely responsible for success in the distant countries.

But new methods keyed to the tempo and standardization of American industry are now being developed in this country. In one, described by Mr. George A. Kubler, of New York City, the impression of type and engravings is made into a film of metallic and chemical emulsions instead of into the soft surface of an ordinary paper matrix. These emulsions are coated over the surface of an ordinary mat.

"The face of the new coated matrix is smooth to such a degree that the original plate to be reproduced, no matter how fine the screen, is not affected by the grain of the texture of the papier-maché base, as is the case with ordinary and special matrices," Mr. Kubler said. "Type and engraving impressions are made into this surface under pressures of from 25 to 400 tons."

How European secrets were rediscovered in this country was told by Mr. Arnold A. Schwartz, of Dunellen, N. J., who said that a stereotyping plant was brought from Switzerland in 1923 in the hope that it would work as well here as in Europe. Two foreign workers were sent with the machinery. Plates made by this apparatus were of such poor quality, however, that they could not be used, rough matrix paper having been found to be the chief fault. Now, after years of research, the difficulties have been overcome, he said. A satisfactory paper and a properly alloyed metal have been developed, so that the new apparatus is operated at full capacity. Mr. Schwartz believes printing from these stereotype plates equals that produced from high-grade, lead-moulded, nickel-plated electrotypes.

ITEMS

THAT unusually mild weather during the past winter has left insect eggs and hibernating pupae in an unusually favorable position to pursue their trade of trouble-making as soon as the country warms up and gets green again, has been indicated in a survey by the bureau of entomology of the U. S. Department of Agriculture. Grasshoppers especially may be expected to assume pest proportions. From Wisconsin and the Dakotas have come reports of large masses of eggs left by the insects of last year's outbreak. Egg capsules collected in North Dakota and brought into the laboratory gave a 95 per cent. hatch. Another pest that built up a large population in 1931 is the San Jose scale, exceedingly troublesome in orchards. It has survived the winter with very low mortality, and is reported as in-

creasingly abundant from New York south to Georgia, and westward to Illinois, Michigan and Missouri. The codling moth, responsible for "worms" in apples and other fruit, is also highly abundant over the same territory.

MIMICRY in insects, that is, the trick of looking like a dangerous or ill-tasting species or of camouflaging oneself as a leaf or twig, is not the prop of evolution it was once thought to be, according to Mr. W. L. McAtee, of the bureau of biological survey of the U. S. Department of Agriculture. In a report prepared for the Smithsonian Institution he gives the results of a long series of studies he has conducted on the stomachs of birds, determining the numbers and proportions of the supposedly "protected" insects eaten by them. Beetles are taken as one example of the failure of various protective devices. Some of them are mimics. Others have powerful, ill-smelling secretions which are supposed to repel their enemies. Still others have hard shells. Yet, Mr. McAtee says, the birds eat them all.

How the elastic and extensible properties of rubber can be gauged by means of an apparatus which has been in use for many years in France by large bakeries has been divulged in a communication to the French Academy of Science. M. Marcel Chopin, in an investigation carried out under the auspices of the French Aircraft Research Division, used a method of testing thin layers of unvulcanized rubber of known thickness. These were securely fixed over a plate with a central hole, and the pressure needed to blow the thin films to different volumes until they break is recorded by a manometer. This simple method gives the tenacity and extensibility of rubber. It has been previously used to determine the baking qualities of various types of flour.

Two troublesome diseases of potatoes, known respectively as mosaic and "crinkle," have been shown to be of double nature, by the researches of Dr. Kenneth M. Smith, of the School of Agriculture at the University of Cambridge, England. Some time ago it was shown that there was something very queer about the virus diseases of potatoes. When the disease was passed on to the potato in different ways it gave quite different symptoms. This is not at all what one would expect. In human beings, for instance, if a particular kind of malaria is injected, the same symptoms appear, whether the infection was obtained by a bite of a mosquito, or by injection from a syringe. In the potato, however, when the mosaic disease was inoculated, one set of symptoms appeared if it was inoculated with a needle, and another different set of symptoms appeared if the disease was transmitted by means of an aphid, or plant louse. Both inoculations "took," but the symptoms were different. The same sort of thing occurs with another virus disease called "crinkle." Dr. Smith has now found that actually there are two viruses concerned in potato diseases, which he calls "x" and "y." Inoculation by the needle transmits both "x" and "y," but the plant louse transmits only "y."

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SCIENCE NEWS

Science Service, Washington, D. C.

THE GROWTH HORMONE

By WATSON DAVIS

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A GLIMPSE into the future when sexless human beings will be produced and when short people can be made tall by injections of a growth-promoting hormone was given by Professor Herbert M. Evans, of the University of California, in his presidential address to the American Association of Anatomists, meeting in New York City.

Before taking the distinguished anatomical research scientists into such a future as H. G. Wells might describe, Professor Evans, known as the discoverer of the antisterility vitamin E and for his work on hormones, announced the following important discoveries made by himself and his co-workers.

1. The pituitary gland, situated in the exact center of the head, produces in its front portion two distinct kinds of powerful secretions or hormones, one of which is growth-promoting and the other of which is sex-gland stimulating.

2. The growth hormone injected daily into animals from which the pituitary gland has been removed turns them into normal-sized, sleek-coated, active and healthy animals possessing an undeveloped infantile sexual system. This creation of adult creatures without a developed sexual system is a proof of the separation of the growth-promoting hormone from the sex-stimulating hormone, accomplished by very precise chemical process.

3. The growth hormone is strangely converted into the sex-stimulating hormone by means of the chemical substance found in the urine of pregnancy.

4. An overdose of growth hormone produces diabetes in normal animals.

5. The growth hormone not only promotes growth but it is also a necessary stimulus for some other sister glands of the body, notably the adrenal. Dr. Evans's work shows that his growth hormone is needed in some mysterious way by the adrenal cortical tissue before it can manufacture its own hormone that cures Addison's disease and is necessary to normal life. The adrenal cortex hormone was recently purified for clinical application by Dr. W. W. Swingle, at Princeton, and Dr. Frank A. Hartman, at Buffalo. Dr. Evans's work shows that the growth hormone is the secretion of the pituitary which stimulates the adrenal and thyroid.

The growth-promoting hormone has already been applied to at least one human case of dwarfism, although Dr. Evans did not comment on this case in his address. A young girl suffering from arrested development was given injections and her height increased about four inches.

"It is said that the Mikado wished to add to the stature of the Japanese soldiers," said Professor Evans commenting on his work. "This growth-promoting hormone should be able to do it, but even the Mikado could not pay the price that it would cost at present. The cost of producing the growth pituitary hormone is prohibitive. It may take a decade to determine its formula and even longer for the chemist to make it in the form

of pretty white crystals with coal tar as the raw material. We are the faint beginners in this work. Perhaps *Science Service* will write the story in 1955."

Unlike Alice-In-Wonderland, once growth is attained, shrinking can not be accomplished. Some feel that growth might be arrested by injuring the pituitary anterior lobe by x-rays or some other method, but this would be a very dangerous procedure.

His production of full normal growth in animals without sex development by means of the growth hormone caused Professor Evans to remark: "Writers like H. G. Wells, Julian Huxley and J. B. S. Haldane might explain that one of the greatest social problems to which man is heir could be solved by transferring this achievement to the human race."

The production of diabetes by an overdose of growth hormone was a big surprise in Dr. Evans's work, although it had been known that animals without pituitary glands were unusually sensitive to insulin, the hormone used to combat diabetes.

At his Berkeley, California, laboratories Dr. Evans had the assistance of the operative skill of Richard Pencharz, the chemical genius of Karl Meyer and the biological analytical work of Miriam Simpson. A decade of work on the growth hormone led up to the present discoveries. Professor Evans gave great credit to other workers in the same field, particularly to Professor P. E. Smith, of Columbia University, who detected precocious sexuality after portions of the pituitary gland had been implanted in rats deprived of their own pituitary glands.

"Because of its manifold relations," said Professor Evans, "the growth hormone will now surely be conceded to be one of the most important secretions of the body. It has basic physiologic importance quite apart from being essential to growth."

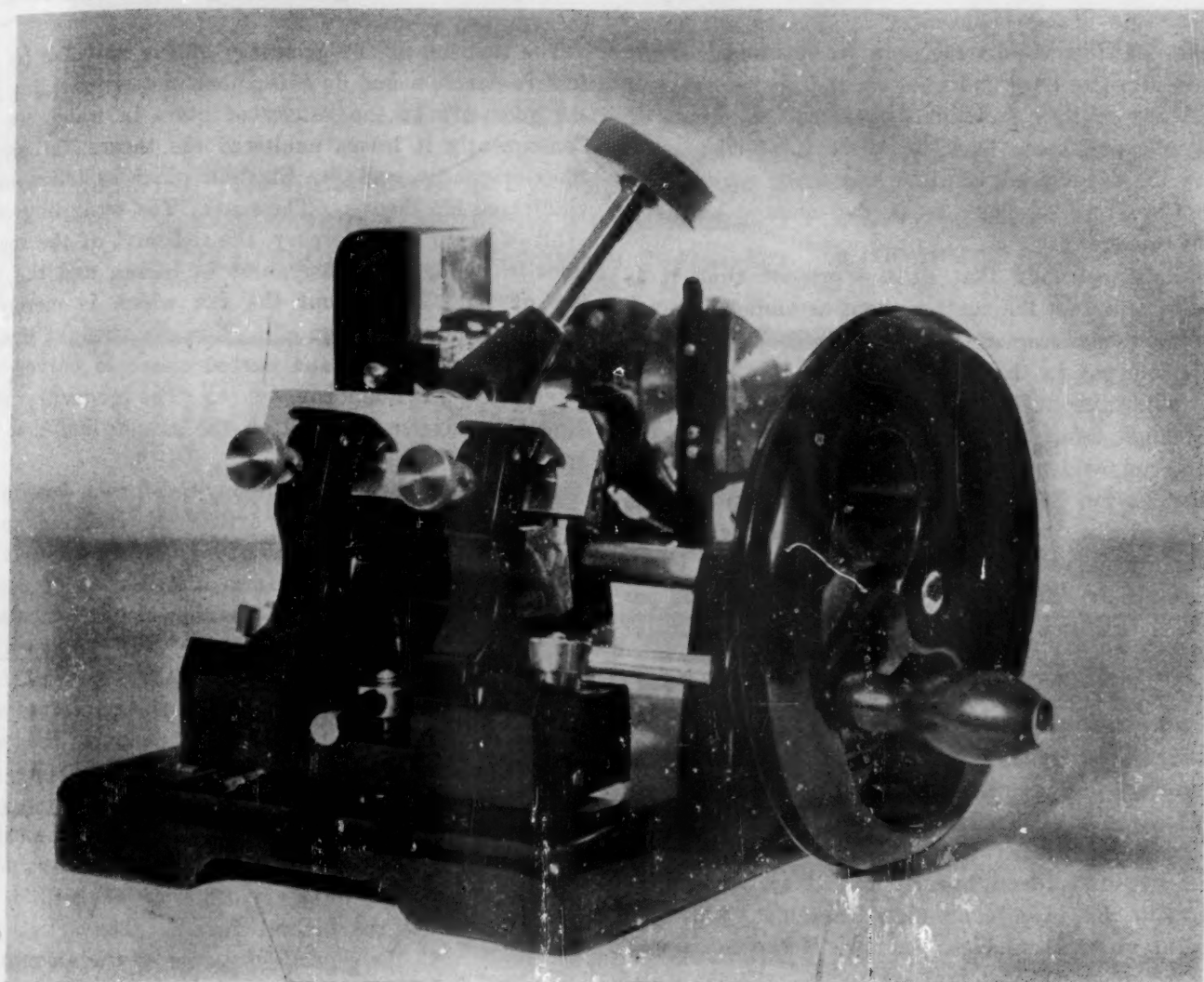
THE CURVATURE OF SPACE

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PROFESSOR ALBERT EINSTEIN says that space may be and probably is the sort of uncurved, three-dimensional space that Euclid imagined. Although he in a sense scraps the less familiar and more complicated brands of space-time that he has been using, this does not affect the validity of relativity, which has been at the foundation of much scientific thinking for two decades.

Professor Willem de Sitter, Dutch astronomer, who had built his own shape of universe on Einsteinian foundations, joins with Professor Einstein in espousing space which is on the average Euclidean. These two eminent astrophysicists conceived the new kind of universe when working together recently at Mt. Wilson Observatory and their joint announcement is made in the March issue of the *Proceedings of the National Academy of Sciences* just issued. Professor Einstein is now en route to his home in Germany while Professor de Sitter is traveling in South America.

This joint announcement, that is sure to cause a furore in the world of science, means that the universe around us may be not only unbounded but infinite, in-



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stead of finite and unbounded as Einstein and his followers have previously believed.

In the Euclidean universe now re-enthroned, light travels in straight lines and goes on and on forever and ever. A ray of light would not traverse the circuit of the universe and come back to where it started as it would in the superseded Einstein and other varieties of space. Curvature of space is on the average banished from the universe.

"We must conclude that at the present time it is possible to represent the facts without assuming a curvature of three-dimensional space," Professors Einstein and de Sitter say in their report.

Two important developments made Einstein and de Sitter change their universes. One of these was the piling up of evidence at Mt. Wilson Observatory at Pasadena, by Dr. Edwin P. Hubble and others that the shift toward the red of spectrum lines in light from far distant nebulae is evidence that the universe is expanding at a terrific rate, as high as 15,000 miles per second and that the farther away the nebula the faster the recession.

The other factor was the demonstration by Dr. Otto Heckmann, privat-dozent in astronomy at the University of Göttingen, Germany, that an expanding universe can have matter throughout it and still be Euclidean. When Einstein built his first universe he did not dream of an expanding space. He thought it static and constant in size and found himself forced to make space curved to fit this idea. This gave his famous finite but unbounded universe which, upon Dr. Heckmann's suggestion, he and de Sitter now revise.

Into the equations of Einstein relativity which have stood the test of time, Professors Einstein and de Sitter, following Heckmann's lead, have inserted both Euclidean space and the recessional velocity of the nebulae indicated by the expanding universe idea and the Mt. Wilson measurements of red-shift in light from the nebulae. They were then able to compute the density of matter in the universe and found that it compares favorably with the ideas that are current as to how matter is spread throughout space on the average.

It is almost impossible to imagine how thinly spread on the average is the matter in the universe. One pound of matter spread throughout a sphere sixteen times the diameter of the earth would give this extremely small density of matter. And as the universe is expanding at a super-terrific rate at extreme distances outward, always getting larger as it were, the density of the matter in the universe must be getting less and less.

Professors Einstein and de Sitter observe, however, that as more astronomical data are gathered it will undoubtedly be possible to determine with more precision the density of matter in the universe. If it should turn out that there is more matter per volume of space, then it will be necessary to return to the original Einstein space even with an expanding universe. If the matter is more sparsely distributed, it will be necessary to learn to live in a space of average negative curvature, such as Lobatschewski, the Russian scientist, dreamed of a century ago. In this strange space an infinite number of

lines parallel to a given straight line can be drawn through any point.

The revision of the geometry of the universe by Professors Einstein and de Sitter does not appreciably alter the geometry of the galaxy of stars in which we live. Consequently it leaves unaltered the theoretical predictions originally made by Einstein which so triumphantly vindicated his theory. These are: The wriggling of the orbit of the planet Mercury, the red-shift of the spectral lines in the sun and companion of Sirius, and the bending of light rays about the sun which is merely the Euclidean interpretation of a Riemann straight line. A straight line in Riemann curved space is curved when interpreted in Euclidean space. The geometry of an Einstein universe is based on the assumption that light travels in straight lines.

Professor Richard C. Tolman, California Institute of Technology, wires: "The article of Einstein and de Sitter in the *Proceedings of the National Academy* shows, if we assume a uniform distribution of material in the universe and assume the cosmological constant to be zero, that our present knowledge as to the density and velocity of recession of matter can be accounted for, if we ascribe the value zero to the spatial curvature of the universe. Our present observation data are thus shown to be insufficient to distinguish between the three theoretically possible cases of positive, negative or zero curvature, and hence we can not now say whether the universe is closed, hyperbolic or flat. It is possible that sufficient data to throw more light on such questions will be available in the not too distant future. The article deals, of course, with the spatial curvature of the universe as a whole when looked at from a large scale point of view and does not affect our views as to the curvature of space in the neighborhood of individual gravitating bodies."

AGE OF THE EARTH AND OF THE STARS

A NEW clock for measuring long periods of time may prove the rotation of the great galaxy of stars in which the solar system is located, Professor Robert H. Baker, director of the University of Illinois Observatory, suggested in an address during the dedication of the new building housing the great Harvard collection of four hundred thousand astronomical photographs.

The revolution of the Milky Way, which occurs about once in four hundred million years, would supplement the rotation of the earth, which measures the day, and the swing of the earth around the sun, which measures the year.

When the dinosaurs existed, some two hundred million years ago, Professor Harlow Shapley, director of the Harvard College Observatory, said in commenting, the solar system was on the other side of the galaxy.

The age of the earth is not less than eighteen hundred million years, and probably about two thousand million years, as measured by the radioactive clock, according to Professor Arthur Holmes, of Durham College, England. Accurate determinations of the amount of helium in rocks give the geologist information on their age, because helium is given off at a known rate by the disintegration of radioactive uranium and thorium elements in the rocks.

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Used widely since its first publication in 1923, this *Course in General Chemistry* has been found to give students taking their only chemistry course a lasting insight into the scientific method, and to prepare the others especially well for further work. Its approach to qualitative analysis is particularly good.

The New Edition

The purpose of the revision has been to bring the content up to date throughout, to add several new experiments in order to give the instructor greater liberty of choice, and, in general, to make the book more teachable. Among the various additions and changes—

Another assignment dealing with Molal Volume has been added.

The experiments on the measurement of hydrogen ion concentration have been revised to include many of the Clark and Lubs indicators.

The measurement of the electromotive force of simple cells has been introduced in the study of oxidation and reduction.

Other added assignments are: A Quantitative Study of the Solubility Product; Chemistry of Manganese and the Use of Permanganate in Quantitative Analysis; Preparation and Properties of Colloids.

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PRINCIPLES OF CHEMISTRY

By Joel H. Hildebrand

University of California

Complete announcement of the third edition of this general text, to be published this spring, will be made in a later issue of this publication.

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The oldest known rocks exist in North America. Up until a few weeks ago uraninite from the Black Hills, South Dakota, held the record with 1,460 million years of age, but radium-bearing rock from the radium bonanza at Bear Lake in northern Canada has shown nearly the same age, and rock from Manitoba assays an age of eighteen hundred million years. As these rocks were molten when laid down and injected into existing rocks, the rocks around them must be even older.

With increasing age the earth is not getting any feebler in energy, Professor Holmes observed. In fact, in the Tertiary age, which led up to the appearance of man, the earth seems to have been more active than in earlier ages. Professor E. W. Brown, of Yale University, stated that new estimates of the age of the earth have disturbed the astronomer's confidence in the stability of the solar system. Although he feels no concern about the immediate safety of the earth, he can not tell just what it was doing two thousand million years ago when its crust was formed. Professor P. W. Bridgman, of Harvard, warned that it was unsafe to theorize as to what had happened thousands of millions of years in the past and what would happen far in the future because we have only a few hundred years of time on which to base ideas.

The age of the universe suffered an extreme pruning at the hands of Professor Ernst J. Öpik, Estonian astronomer working at Harvard. Ten years ago the universe was thought to be ten million million years old; now Professor Öpik divides these old estimates by a million or so and makes the universe about the same age as the earth, about three thousand million years.

THE PRODUCTION OF TUNG OIL

THE tree that supplies \$12,000,000 worth of tung oil to the United States each year is being taken from its native China to the far southern states of this country. Already about 25,000 acres of land have been planted in trees producing tung oil, Dr. Henry A. Gardner, director of the scientific section of the American Paint and Varnish Manufacturers' Association, told members of the American Chemical Society meeting in New Orleans. He estimates that between 50,000 and 100,000 acres of trees will be needed to supply the quantity of oil that has been imported from China. Tung oil trees have been grown successfully in California, Alabama, Louisiana, Mississippi and Florida. However, California is not considered a favorable state for the commercial growing of the trees because of the lack of low priced land in sections where the soil and climate conditions are suitable. The largest plantings have been made in northern Florida.

Seeds of a tree of the genus *Aleurites*, which is native to China, produce tung oil. They ripen about October in both China and North America and are crushed in a mill similar to that used to press peanuts for peanut oil. The fruit which contains the seed is about the size and appearance of a small russet apple. The tree is deciduous, shedding its leaves in the fall and covering itself with new foliage in the spring. It will stand light frosts.

The Chinese use tung oil for waterproofing, making

native lacquer and ink. In this country, in addition to its applications in the manufacture of varnishes and varnish paints, it is "used in making insulating compounds, as an ingredient in automobile brake linings, in gaskets for steam pipes, in linoleum and table oilcloth for waterproofing fabrics, paper, cartridge shells, etc. as a binder for wall board and plastic synthetic lumber or lacquers, primers, pipe coating plastics, synthetic resins, battery jar compounds, airplane tubing fillers, etc."

The first tung oil seeds were brought to this country in 1905 by David Fairchild, plant explorer of the U. S. Department of Agriculture, and planted at the government experiment station at Chico, California. Seedlings were distributed to southern states. Extensive plantings, however, were not made until eight years ago.

ITEMS

ORANGE juice may travel to market frozen solid in blocks, to be thawed into potable palatability by the consumer. But before this is possible more must be known about its chemical makeup and physiological behavior, according to Dr. M. A. Joslyn, of the University of California, who spoke at the meeting of the American Chemical Society. Oxidation appears to be the principal cause of deterioration in frozen orange juice, Dr. Joslyn said. It can be almost completely eliminated by de-aeration of the juice and handling under an atmosphere of inert gas, such as nitrogen. The commercial application of this method is feasible and yields a satisfactory product.

THE basic life processes of vegetarians proceed at a slower rate than those of meat-eaters, in Europe as well as in America, according to measurements by Professor G. Wakeham, of the University of Colorado. His results were reported to the American Chemical Society. Professor Wakeham made measurements of the basal metabolism, the body's rate of expending energy when resting, for fifteen strict life-time European vegetarians. He found that their basal metabolic rates were, on the average, nine per cent. below the normal rate. Seven to ten years of vegetarianism, said Professor Wakeham, are required to produce this effect. This was found by examination of vegetarians of from one to fifteen years' standing. Professor Wakeham recently made a similar study of American vegetarians.

THE question of whether a person will be naturally right-handed or left-handed is decided before birth, Miss Stella M. Leche, of the department of anatomy, Tulane University, told members of the American Association of Anatomists. Miss Leche has studied the ridges and surface markings of the palms of 244 left-handed persons and compared them with those of 300 persons chosen at random. These markings on the skin of the palm are known to be different for the right and left hands. Likewise, they show which is the dominant hand, that is whether the person tends to use the right or the left hand for writing, cutting and other similar tasks. Since the nature of the markings on the palms is determined long before birth, Miss Leche concluded that the matter of which hand will be dominant is also decided at this early period in the individual's life.

GENERAL BOTANY FOR COLLEGES

By

RAY ETHAN TORREY, Ph.D.

*Assistant Professor of Botany
Massachusetts State College*

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SCIENCE NEWS

Science Service, Washington, D. C.

MAGNETO-OPTIC CHEMICAL ANALYSIS

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"A POWERFUL new tool for research, one thousand times more sensitive than the most delicate methods of analysis now used," is the report Dr. B. S. Hopkins and Dr. Gordon Hughes, of the University of Illinois, gave the American Chemical Society on March 29, following a study of the magneto-optic method of analysis developed by Dr. Fred Allison, of the Alabama Polytechnic Institute, and used in the discovery of the last two of the 92 chemical elements.

Investigators at Illinois are devising improvements to Dr. Allison's method which they expect will make it a dependable tool for routine use in the laboratory—one with which the limits of human knowledge can be extended to present "unknowns" where infinitesimals of one millionth of one per cent. are matters of importance.

While other investigators have worked with the magneto-optic method to check Dr. Allison's reported discovery of the last two elements of the periodic table, which he named virginium and alabamine, the sole object of the present investigation is to develop the Allison method into a dependable laboratory operation. Dr. Hopkins and Dr. Hughes found that the magneto-optic method surpasses a thousand times analysis by arc spectra, its nearest rival in sensitivity. The limit of accuracy of the x-ray spectra method is one tenth of one per cent., the arc spectra will analyze to one thousandth of one per cent., depending on the substance under examination, and the magneto-optic method easily extends this limit to one millionth of one per cent. This accuracy is achieved in analysis of rare earths, that part of the periodic table where analysis is most difficult because the elements are so closely "jammed together" there.

The Allison method uses simple apparatus, which costs much less than that required in other forms of analysis. Two hundred dollars would cover the cost of that employed in the University of Illinois investigations. Dr. Hopkins and Dr. Hughes also reported that the Allison analysis requires much less of a "sample" than other methods and that the substance is not destroyed as is the case with the chief forms of analysis now used. But their investigations have led them to agree with other scientists who have found that the Allison method in its present form is not dependable.

"Results are obtained from the instrument by noting faint light flickers with the eye," Dr. Hopkins told Science Service. "Dr. Allison and his workers have trained themselves to make these observations and they have become very efficient, but others have tried reading with the eye and they have found that they can not depend on it. Dr. Allison, himself, admits that some eyes can never be trained to read the so-called 'minima' and that others will always be of little value.

"Our work has been directed at eliminating this fault," he continued. "Dr. Hughes has already improved the light source, a spark which has been unsteady. He is now developing a photographic method of reading

the 'minima.' The faintly varying light makes a record on a very sensitive moving photographic plate and this is examined under a microphotometer, which is much more accurate than the eye in locating the spot of slight light variation."

RESEARCH ON VITAMINS

VITAMINS are losing their mystery. Spectacular attacks on these complex diet essentials during recent months by investigators in different parts of the world have yielded valuable knowledge about the way they are made, their structure, and their effects on other substances.

Acquisition of new knowledge has been so rapid that it would appear that text-books and teaching will have to be completely revised, Dr. R. Adams Dutcher, of the department of agricultural and biological chemistry of Pennsylvania State College, said in a report to the American Chemical Society meeting at New Orleans. Dr. Dutcher summarized this advance in his report.

Important facts have been learned about the relation between vitamin A and carotene, the yellow coloring matter of carrots, it appears from Dr. Dutcher's report. The carotene molecule is apparently split in the liver to form vitamin A, and some chemists believe this change is caused by a potent organic catalyst, or enzyme, which they have named "carotenase." Others claim to have found in fish liver a substance even more potent than carotene. The structure of the vitamin A molecule has been almost completely worked out.

Vitamin B seems likely to be made up of five different vitamins, or fractions. One fraction, which prevents beri-beri, has been definitely established, and a second form, which is known in this country as anti-pellagra vitamin G, has been recognized. Some chemists believe that a third fraction is necessary for growth in pigeons; work has been done which shows that a fourth fraction is responsible for growth in rats; and evidence has also been obtained for the existence of a fifth fraction necessary for rat growth, which is different from the fourth in stability.

Formulas have been ascribed to vitamins A and B and it appears that this step is near at hand for the anti-scurvy vitamin C, Dr. Dutcher reports. Narcotine, a by-product in the manufacture of morphine from opium, may be the parent substance of vitamin C, in much the same way that inactivated ergosterol is the parent of the anti-rachitic vitamin D, the report states.

The most outstanding recent development concerning vitamin D is its preparation in crystalline form which has been accomplished by a number of scientists in different countries.

OPIATES AND VITAMINS

CHEMISTS are building a bridge over the seemingly impassable gap between destructive, habit-forming drugs and essential, building elements of diet, it appears from a report made to closing sessions of the American Chemical Society. From an alkaloid derived from the age-

old drug, opium, there may come, after a series of chemical changes, a substance bringing the benefits of the anti-scurvy vitamin C, possibly the vitamin itself.

Spurred by the recent discoveries which indicate that the effects of vitamin C can be obtained from a substance easily made from narcotine, a by-product in the manufacture of morphine from opium and which is now of little value, chemists throughout the world are racing to learn more about narcotine and its compounds. Progress of an American laboratory was described by Dr. Carl R. Addinall, research chemist with Merck and Co., at Rahway, New Jersey. He told how he has made from narcotine, by methods simpler and more general than those used in the past, a number of compounds, the proportions and transformations of which may become valuable allies in the investigation of citrus fruit juices and other foods well supplied with vitamin C.

"Chemists already knew how to make narcotine into the more rare narceine," Dr. Addinall told Science Service. "We have found that this transformation can be extended to include the changing of narcotine quaternary salts into the acid salts of narceine esters, narceineamide and of narceine itself."

Although there now is no important use for these more easily made substances, they may become of value at any time, it was pointed out. It depends on whether Dr. Otto Rygh, Norwegian chemist, fulfills his recent claim that he can make from narcotine a substance that will prevent scurvy and which may be vitamin C. When these claims are verified by experiments of other chemists, every little bit of knowledge about the chemistry of narcotine will become very important.

Substantiation of the work will also be of great benefit to far northern and far southern countries where fruit juices with their vitamin C are scarce and scurvy is common. It will then be possible to combat this disease with a substance which can be cheaply made from a product that is now wasted.

Dr. Rygh announced the first of the year that by heating narcotine with hydrochloric acid he had obtained a substance very much like vitamin C, possibly the vitamin itself. He admitted, however, that it is likely to be a mixture of the potent substance with impurities. When he fed it to guinea-pigs suffering from scurvy, the pigs were cured of the vitamin C deficiency disease.

The claims of Dr. Rygh are contested by a prominent English biochemist, Dr. Silva, who reports that the substance he prepared from narcotine by the method adopted by Dr. Rygh did not cure guinea-pigs of scurvy. The work of the Norwegian chemist is now being examined in other laboratories throughout the world.

RADIOACTIVE MEDICINES

A WARNING against the unwise use of "radioactive" waters has been reissued by the Food, Drug and Insecticide Administration of the U. S. Department of Agriculture. While this warning was too late to save Eben M. Byers, whose death from radium poisoning, resulting from drinking a radioactive water, has been reported, it is only the latest of many such warnings which this branch of the federal government has repeatedly issued since 1926.

The Food and Drug Administration can not prohibit the sale or transportation of radioactive substances within the United States, even though they may be highly dangerous, any more than it can prohibit the sale or transportation of any poison, such as arsenic, Dr. P. B. Dunbar, assistant chief of the administration, explained. It can only prohibit incorrect labelling of drugs. Radithor, the product used by the late Mr. Byers, was correctly labeled. It claimed to be radioactive and it is, highly so.

Advertising claims do not come under the jurisdiction of the Food and Drug Administration but under the Federal Trade Commission. This body on January 17 of this year ordered the makers of Radithor to "cease and desist" from advertising that their product was harmless and that it would improve a long list of ailments.

Most of the radioactive waters on the market contain very little radioactive substances, only 2 or 3 units in a little over a quart of water. Their use is probably harmless unless it keeps people from some more beneficial form of treatment. Radithor, however, is a powerfully radioactive substance, and should therefore not be used except under the direction of a qualified physician.

When radium is used in medical treatment proper precautions are taken to safeguard the patient and attendants from this substance which is potent for harm as well as for good.

If radium or radioactive substances had been included in the federal caustic poison law, the Food and Drug Administration could have required it to carry the word "Poison" in half-inch high letters on the label. Under this law certain caustic acids and other poisonous products must bear such marking and also the antidote for the poison on the label, Dr. Dunbar explained. No antidote for radium poisoning is known, however.

The Food and Drug Administration can prohibit the sale of radioactive foods, since this comes under the head of adulteration of foods, which is prohibited by the Food and Drug Law. The administration has stopped the importation of a number of foreign food products, such as chocolate, claiming to be radioactive.

SEX HORMONES

THE male hormone, or gland secretion that is responsible for typically masculine physiology in men and male animals, has been prepared for the first time in full purified, crystalline form by Dr. Adolf Butenandt, of the University of Göttingen. Dr. Butenandt has also analyzed it and determined the proportions of carbon, hydrogen and oxygen that enter into its make-up. They are expressed by the formula $C_{16}H_{26}O_2$.

Although other physiologists have been at work on the same problem, the final crystallization of the hormone is regarded as of the greatest importance. When any preparation can be made in crystalline form, that signifies a high state of purity, which makes possible really accurate comparative physiological tests, and may even lead the way to synthetic preparation.

The male sex hormone seems to be very closely related

chemically to its physiological analogue, the female sex hormone. This hormone was prepared first in the United States by Professor Edward A. Doisy, of the St. Louis University School of Medicine, and was announced at the Thirteenth International Physiological Congress at Boston in August, 1929. Subsequently, Dr. Doisy was the first to announce the empirical formula of this female sex hormone, $C_{15}H_{22}O_2$. Dr. Butenandt announced the independent isolation of the female hormone some months subsequent to Dr. Doisy's announcement and the independent analysis a short time after, thus confirming Dr. Doisy's findings. The female sex hormone is already being used in medicine to a considerable extent and it may be anticipated that its male counterpart will likewise find clinical employment after further tests on animals have given more data on which to base its first applications to human cases. Dr. Butenandt, therefore, must be credited with the first isolation and analysis of the male hormone and the independent isolation and analysis of the female sex hormone.

Both the sex hormones are prepared from an ingredient that might well have gone into a witch's cauldron of old—human urine. The female sex hormone can be prepared only from that of pregnant women. However, the long and elaborate processes of condensation and precipitation through which the material must be put before the final few crystals are isolated removes any suggestion of its original repulsive source.

Dr. Butenandt's announcement of the preparation of male sex hormone in crystalline form is made in the German science weekly, *Forschungen und Fortschritte*.

ITEMS

THE ease with which three of the most widely used, yet most dangerously inflammable substances in industry, explode has been determined by G. W. Jones, E. S. Harris and W. E. Miller. They reported before the meeting of the American Chemical Society results of study at the Pittsburgh Experiment Station of the U. S. Bureau of Mines. Methane or natural gas, manufactured illuminating gas, and quickly evaporating acetone, a much-used solvent, were tested. Mixtures of these gases with air were considered inflammable if, when ignited in a closed apparatus, they produced a pressure of six or more pounds per square inch. Mixed with the right amount of air to make the greatest explosion, manufactured gas gave much higher pressures than either methane or acetone, while a mixture of acetone and air built up a pressure slightly higher than that caused by natural gas and air.

THE small gland at the base of the brain known as the pituitary gland produces a hormone which acts as a thyroid "starter" or activator, it appears from the report of Dr. Frank H. Figge and Dr. Eduard Uhlenhuth, of the University of Maryland Medical School, to the American Association of Anatomists. These investigators found that although the thyroid gland is responsible for the change from the larval to the grown-up stage in the axolotl, an animal related to the salamander, the thyroid can not bring about this change by itself.

Axolotls lacking both thyroid and pituitary glands do not metamorphose into the adult stage when given thyroid hormone alone, to make up for the lack of it from their own missing thyroid gland. But when they are given thyroid hormone plus pituitary hormone, the change proceeds as usual.

JUICE of pineapples preserved by the frozen-pack method keeps its power to digest proteins. This is one of the results of a series of experiments conducted at the new frozen-pack laboratory of the Bureau of Plant Industry, U. S. Department of Agriculture at Seattle, under the direction of H. C. Diehl. It has been long known that the juice of raw fresh pineapple has in it a digestive enzyme similar to pepsin in its ability to digest proteins. Pineapple preserved by the frozen-pack method, with the addition of either syrup or sugar, has an attractive flavor and a rich golden color. Although other frozen-packed fruits are now on the market, pineapple preserved in this way has not yet made its commercial debut. Other products which have been satisfactorily preserved by the frozen-pack method in the new laboratory are peaches, Japanese persimmons, apples, several kinds of berries, peas, beans, carrots, cauliflower, mushrooms and other vegetables.

A POTENT extract of normal human stomach juice which will check pernicious anemia when injected into the muscles has been prepared by Drs. Roger S. Morris and Leon Schiff, in collaboration with Drs. George Burger and James Sherman, of the department of internal medicine at the University of Cincinnati. The extract, is thought to contain a blood-forming hormone which the Cincinnati investigators have named "addisin" in honor of Thomas Addison, who first described the disease. That the normal human stomach secretes a substance which prevents the development of pernicious anemia was discovered by Dr. William B. Castle and his associates at the Boston City Hospital, who also found that feeding pernicious anemia patients beef muscle which had been digested by normal human stomach juice checked the malady. Feeding stomach juice itself was not successful, but the investigators have reported to the *Journal of Medicine* that their concentrated stomach juice when injected into the muscles produces an effect similar to that of liver extract.

IT is safe to use hot cement in paving concrete road, tests made under direction of the American Society of Testing Materials have shown. The general belief heretofore has been that hot cement would impair the appearance and strength of the finished product. Some state highway departments require that the cement when delivered on the job must not exceed a standard temperature of 125 degrees Fahrenheit. The tests, however, show that there is virtually no difference in the quality of the concrete when the cement used has a temperature of 180 degrees Fahrenheit or more. The tests were conducted, according to a report printed in the *Engineering News-Record*, on sections of a concrete road in northern Indiana.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE PNEUMONIA GERM

A NEW understanding of the pneumonia germ was presented by Dr. Oswald T. Avery, of the Hospital of the Rockefeller Institute for Medical Research, at the convocation on April 2 of the American College of Physicians in San Francisco. A complex sugar plays a leading part in the germ's disease-producing activities, it appears from the research Dr. Avery described.

The pneumococcus, or pneumonia germ, is surrounded by an envelope of material known as the cell capsule, he explained. Without this capsule the germ has no power to invade the body or to cause disease and it is easily taken up and destroyed by the phagocytes or scavenger cells of the body. This important capsule is probably composed largely of a soluble sugar-like substance which is made by the pneumococcus. Each of the different types of pneumonia germ produces its own specific sugar-like substance.

The sugar of the pneumonia germ is probably not a poison like the poison produced by the diphtheria germ, but it does seem indirectly to hinder recovery from the disease. This is because this sugar tends to bind certain protective substances in the blood and thus to prevent their reaching areas of infection in the body, where they could fight the disease.

Dr. Avery and associates found that the body does not produce any enzyme which can break down the complex sugar of the pneumonia germ's capsule, but a micro-organism found in peat soil does produce such an enzyme. When this enzyme was injected into mice and rabbits suffering from pneumonia, the animals recovered. Likewise, they found that a preparation of this enzyme protected mice from a million times the number of virulent germs which invariably caused death in the untreated animals.

When the enzyme breaks up the complex sugar of the germ's capsule, the unprotected germ is ready prey for the scavenger cells of the body. Thus recovery depends both on the presence of the enzyme and on the body's ability to produce scavenger cells to destroy the unprotected pneumonia germ.

Dr. Avery also told how, in the course of this research, an important skin test was developed from the sugar of the pneumococcus. When a little of this sugar is injected into the skin of patients recovering from pneumonia, a reddened spot with a wheal in the center of it appears. The capacity of the skin to react in this way with the germ's sugar is closely connected with recovery from the infection. The results indicate that this skin test may be significant in foretelling the outcome of the disease, and may also be of value in determining the dosage of antipneumococcus serum to be given in treatment.

ENCEPHALOMYELITIS

Two cases, one of them fatal, in which men have apparently been afflicted with a newly-discovered brain disease of horses and mules were reported by Dr. Karl

F. Meyer, of the George William Hooper Foundation for Medical Research, University of California, at the meeting of the American College of Physicians on April 4. In view of his findings, Dr. Meyer urged the assembled physicians to examine the brain and spinal cord of every fatal human case of encephalitis which was not typical in symptoms and course.

The two cases which Dr. Meyer described occurred in cattlemen who had been caring for horses afflicted with the equine form of the disease. He could not prove conclusively that they had suffered from the same disease because he was unable to examine the brain of the man who died. But from the symptoms and the fact of their close contact with the sick horses, he felt sure they had contracted the disease from the animals.

The equine disease, called encephalomyelitis, first appeared in California during the summer of 1930. It started with the onset of hot weather in June or July and with the onset of cooler weather in October, disappeared. The same thing occurred again in 1931. During these two seasons, about 6,000 horses died. Dr. Meyer expects the disease to occur in epidemic form again this season when the warm weather returns, as several cases have been reported from the San Joaquin Valley during the past two weeks.

The malady is caused by the type of germ known as a virus, which attacks the brain and spinal cord of the animal. It is apparently identical with the so-called "cerebro-spinal meningitis" which has been reported in various parts of the United States during the past 70 years. The disease caused heavy losses in the West Central States about 1912 under the name "Kansas-Nebraska horse plague."

Horses and mules are the only animals known to be affected under farm conditions, although the studies of Dr. Meyer and associates showed that the virus found in the brain and spinal cord of sick horses can produce the disease in horses, monkeys, rabbits, guinea-pigs, rats and mice when injected into the brain. Two types of the disease occur: the sleepy type in which the animals drowse until disturbed, when they may have convulsions, and the walking type in which the animals pace around and around the field.

An attack of the disease, even so slight as to escape notice, seems to give the animal immunity, that is, to protect it from subsequent infection in the majority of cases. Investigations at the Hooper Foundation are being made with the hope of producing a serum that may be used in treating the animals or a preparation that will confer immunity on them. Encouraging results have been had in a small number of cases and Dr. Meyer and associates expect an opportunity to determine the real value of their preparations during the anticipated 1932 epidemic.

MAGNETIC POLES

THE idea that there can exist in nature a magnetic pole free from the clutches of a magnetic pole of oppo-

site sign is receiving discussion in British scientific circles. The possibility that one part of magnetism might be separated from the other was suggested by Dr. P. A. M. Dirac, the mathematical physicist of the University of Cambridge, who recently spent some months in America at Princeton University. He is recognized as one of the most brilliant of contemporary physicists.

Roughly expressed, it is conceived possible and consistent with the quantum theory of physics that a compass needle of the smallest size could be cut in two in the middle and the north pole separated from the south. No one has ever been able to separate the two poles of a magnet. Classical theory in physics considers magnetism as a manifestation of electricity, each molecule being an elementary magnet due to the orbital revolutions of the electrons inside.

In his theoretical calculations, Dr. Dirac was looking for the reason for the existence of the smallest electric charge, the electron. He found a connection between this smallest electric charge and the smallest magnetic pole, since he obtained a wave equation in his development of the fruitful quantum mechanics of the new physics, whose "only physical interpretation is the motion of an electron in the field of a single pole."

In his further reasoning Dr. Dirac finds that the strength of these lonely magnetic poles is quantized, that is, magnetism occurs in definite amounts or "gobs" in just the same way that all electricity is built up of integral multiples of the smallest electric charge, that on the electron.

Important also is his discovery of a new connection between electricity and magnetism, that allows the calculation of the attraction between the two opposite elemental magnetic poles. It is found to be nearly 5,000 times the attractive force between the electron and the proton, the negative and positive particles of electricity that are the atomic building blocks.

Magnetic poles of opposite sign have never been separated in experiments and Dr. Dirac concluded that this very great attractive force is the reason. This theoretical work may therefore have ushered into the world of science a new entity, the magnetic pole, which investigators can use in postulating how the universe is put together. The magnetic pole may come into its own as a fundamental unit alongside the electron and proton, which are the electricity units, and the photon, which is the unit of light.

Professor O. W. Richardson, of King's College, London, commenting on Dr. Dirac's technical paper that appeared in the *Proceedings* of the Royal Society last September, suggested that the isolated magnetic poles might be useful in explaining ultra-penetrating radiations, such as the cosmic rays. He feels that while it would seem difficult for such entities as the poles to be created, the possibility of their existence may have great influence on current views of how the universe is put together.

INTERIOR OF THE EARTH

EARTH's interior is "boiling" like a soup-kettle, with the continents floating on the surface like flakes of

scum. Only, the "soup" does its boiling in terms of millennia rather than minutes, and is thousands of times as stiff as glass, so that its movements are naturally slow. This is, in rough outline, the picture sketched by Professor Arthur Holmes, of the University of Durham, England, to account for the rate at which the earth is losing its heat. He spoke at a meeting of the Washington Academy of Sciences.

The first effort to calculate the age of the earth from the known rate of heat radiation was made by the famous English physicist, Lord Kelvin. He assumed an originally molten globe, with no energy resources beyond the original dowry it brought with it from the sun. The maximum age allowed by Lord Kelvin, forty million years, was protested by geologists and evolutionists as altogether too short to allow for all the events they knew had happened.

This impasse between geophysics and geology stood until the discovery of radium and other radioactive elements in practically all the rocks of the earth's crust. This gave the planet an accessory supply of energy, which permitted a much longer time for its cooling down to its present state, and incidentally allowed the geologists all the time they wanted.

As a matter of fact, the first examinations of granitic rocks for radioactive elements yielded an embarrassment of riches in energy. There was too much of it to account for the earth's radiation, if all the rocks were equally endowed. But it was soon learned that this was not the case. Granitic rocks from near the surface contain far more radium and allied elements than the basalts from deeper in the crust; and the basalts in turn are very much more radioactive than are the still deeper rocks, called peridotites, that are assumed to make up the bulk of the stony material of the globe, filling all the space between the surface crust and the rigid central core of nickel-iron that occupies about one third of the earth's diameter.

But even with the bulk of the earth's radium thus concentrated in the crust—about sixty miles of the outer rocks—there still remains the problem of the transfer of the interior heat to the surface; else part of the earth's interior would be too fluid for our ultimate comfort, and the rest too stiff.

Two theories have been proposed to account for this. One is supported by Professor John Joly, of the University of Dublin. He thinks in terms of "waves" of thermal energy starting from the interior and working outward toward the surface, through a semi-fluid mass. As each wave travels outward, it liquefies the zone through which it is moving, and as it passes leaves it solid again. Naturally such a wave would move very slowly, but it would carry with it a great increase in energy; so that it could well give rise to revolutionary geological events on its arrival at the surface.

Professor Holmes's "soup-kettle" hypothesis visions events in the interior as consisting not of waves of energy passing outward through a stationary mass, but as a movement in the mass itself, carrying the energy with it. The deep, peridotitic stony mass, he thinks, may be sufficiently fluid to move with slow convection

currents, like the liquid in a kettle when it begins to boil; rising in the equatorial regions, flowing along at the surface just beneath the sixty-mile-deep solid crust, and sinking again at the poles, to begin the cycle anew.

This circulation from the poles to the equator and back again is not the only one; other convection currents are taken into account in Professor Holmes's hypothesis, conditioned by continents, ocean basins and other factors. The picture is also modified by the heating effect of the central metallic mass at the earth's core, which plays the part of a stove—except that it is in the kettle rather than under it.

CONGRESSIONAL INVESTIGATION OF INVENTIONS

THE claim of an invention of a deadly weapon of destruction giving the nation possessing it command of world military affairs, which the Congress is now considering, is viewed with skepticism in scientific circles.

Extreme secrecy and broad claims do not inspire the confidence of authorities in the world of science.

If the resolution introduced to give exceptional consideration to this claimed invention of Lester P. Barlow, of Stamford, Connecticut, should be passed, the Congress would not be following the path of recognized scientific endeavor or that of the patent system provided for the protection of inventors and of the public.

Scientists recall that several years ago the Congress appointed a committee to investigate an invention said to extract free available power from the atmosphere. But the inventor, Garabed T. Giragossian, failed to submit his apparatus to the committee.

Singularly, another resolution concerning an invention of Mr. Giragossian has been introduced into the House during the present session of Congress.

Another proposal for getting quantities of power cheaply, which failed to meet tests, is that of Lester J. Hendershot. It was widely reported in newspapers in the early part of 1928. Inventor Hendershot intended to get power from the electricity of the atmosphere.

An apparatus which received wide-spread publicity about 30 years ago was the Keeley motor. It developed that the machine was a fake, power to run the motor being supplied as compressed air through a hollow tube concealed in the leg of a table on which the machine rested.

Recognized scientists always welcome the consideration of new proposals, but they insist that full details be given and that claims be made for only that which has been accomplished in actual experiment. As a rule, inventions announced with the secrecy and broad claims accorded the Barlow instrument of war seldom become important.

Mr. Barlow's claims for the new invention link it with an invention of a flying torpedo that he submitted to the Navy Department in 1917. It is said that the device now being considered will destroy cities and forces of men a thousand or more miles from its operators. The 1917 suggestion was examined by the Navy and declined. Mr. Barlow is also said to have submitted ideas for a submarine escape device. In reply to an inquiry,

the Army could not find record of contact with the inventor.

The name Lester P. Barlow is not in the latest membership lists of the American Association for the Advancement of Science, the American Society of Mechanical Engineers or the Society of American Military Engineers. Neither is he recorded by the most recent Who's Who in America or by American Men of Science.

ITEMS

HOUGHTON comet, newcomer to the heavens, has been photographed at the National Observatory of Argentina at Cordoba, by Astronomer Bobone. This comet was discovered on April 2 at the Cape of Good Hope Royal Observatory. It is moving northward, but is still ninth magnitude, too faint to be seen without telescopic aid and is visible only from the southern hemisphere. Harvard College Observatory has notified American observatories of the Cordoba observation.

THE Hydrographic Office of the U. S. Navy reports that a 7,000-mile voyage across the Pacific just north of the equator has been performed by a drifting bottle. The bottle was picked up among the Philippine Islands. The paper it contained recorded that it had been thrown overboard off the coast of Mexico by Second Officer J. C. Johansen of the American steamer *George W. Barnes*, on July 2, 1929.

ADDING a warning odor and taste to bichloride of mercury tablets would help to reduce the number of accidental poisonings by these deadly tablets, suggests Dr. R. E. Rose, director of the technical laboratories of E. I. du Pont de Nemours and Co., in a note to *Industrial and Engineering Chemistry*. Attention has recently been drawn to the importance of making these tablets a distinctive color and shape. Specifically, Dr. Rose suggests a drop of the higher fractions of synthetic alcohols for giving a warning odor that is both characteristic and not too disagreeable for use in the sick room, and a small quantity of a very bitter substance such as the salt of quinine to give a characteristic warning taste.

A METHOD for packing more power into ultra-short radio waves, the form of transmission which is now the subject of intensive research throughout the world, was reported to the Institute of Radio Engineers meeting in Pittsburgh by Mr. H. N. Kozanowski, of the Westinghouse Electric and Manufacturing Co. Many radio engineers interpret Mr. Kozanowski's achievement as a step toward static-free and fadeless radio. Because ultra-short waves travel in a straight line and can be focused, it has been predicted that they will largely overcome these two bugaboos of the longer waves now used for broadcasting. One of their great disadvantages has been the limited power with which they could be used. The new development, however, makes possible an output of at least five watts from a 60-centimeter wave-length transmitter while, according to published literature, the energy available in this range has been only a fraction of a watt.

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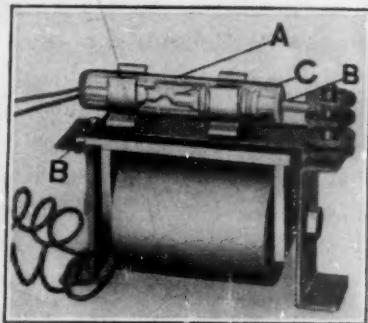
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SCIENCE NEWS

Science Service, Washington, D. C.

THE EFFECTS OF FEDERAL ECONOMY ON THE GEOLOGICAL SURVEY

SCIENTIFIC research work in the U. S. Geological Survey of the Interior Department will suffer a 29 per cent. cut for the year beginning July 1 next, as compared with the fiscal year now in progress, and in the whole operation of the survey about 250 employees, many of them specialized scientific workers, will be cast adrift to look for whatever work they may be able to find.

This is the net result of the Senate's recent 10 per cent. slashing of the already reduced Geological Survey budget. It is understood that House conferees are ready to accept these cuts. For geological surveys and research, there will be spent \$440,000 in 1933 compared with \$619,500 in 1932.

The reduction in funds "will inevitably mean a reduction of at least one third in effective work and accomplishment," Dr. W. C. Mendenhall, director of the U. S. Geological Survey, declared in response to an inquiry by *Science Service*.

"With less money for salaries and expenses," Dr. Mendenhall continued, "the staff must be sharply reduced and field work correspondingly curtailed. Not only must many problems, long awaiting attention but as yet untouched, be indefinitely postponed, but still worse, some of the projects that are already under way must be postponed or abandoned, even though nearing successful completion. This is a real loss to the nation, for when the scientists are discharged before their investigations are complete and their reports prepared for publication, the public loses the benefits that it would gain from the information and derives no value from the money already spent on the investigations thus abandoned.

"In another way, also, a large decrease in the scientific staff will mean serious loss to the public service. Reduction in personnel is far less simple in a scientific bureau than in a manufacturing industry, for the work of many of the scientists is so specialized that the men in general can not be interchanged between types of work. Any one project, whether it be investigation of the extent and value of the mineral resources of a certain area or a less specific research problem, may and usually does require contributions from a number of specialists in mineralogy, petrology, chemistry, physics, paleontology, stratigraphy, physiography and allied subjects.

"These highly trained specialists have been carefully selected for their qualifications as research workers in subjects that are essential elements in a properly organized geological survey. Some of them have had many years of service and experience in the survey. Others are younger assistants in training to fill vacancies caused by death, retirement or voluntary separation, for these special lines of work must be continued effectively without a break as long as the survey is called upon to function successfully and efficiently. The dropping of a quarter or a third of the scientists will leave gaps that

can only in minor part be bridged, with inevitable loss in effectiveness and accomplishment."

A reduction of \$75,000, or 18.7 per cent., in the appropriation for geologic surveys valuable to the mineral industry, is proposed. Fundamental research is cut \$60,000, or 60 per cent. Between 35 and 40 employees will be forced out in these cuts. Volcanologic surveys lose \$20,000, or 57 per cent., and the Alaskan mineral resources work is cut \$24,500, or 29 per cent. Cuts for these research activities as proposed by the Senate total \$179,500.

In addition to these research work curtailments, the Geological Survey funds for topographic surveys, necessary to the nation's mapping, are cut \$100,000, meaning the loss of 94 employees. A salaries fund cut will mean the loss of 17. The appropriation for gaging streams is reduced \$120,000 to the sum of \$600,000, but as \$450,000 of this is available only in cooperation with states and municipalities which are cramped themselves for funds, 40 to 50 persons in this work will probably lose their jobs.

THE COST OF PLANT DISEASES

TAXES on farm products, heavier than any legislative body would ever dare to levy, are assessed every year by plant diseases caused by fungi, bacteria and other parasitic microbes. This is made evident by a summary just issued by the U. S. Department of Agriculture, covering plant disease damage to the principal agricultural and horticultural crops for the years 1928, 1929 and 1930, the latest dates for which approximately complete figures are available.

Corn, the most important single crop in America, in 1928 had to give up 10.3 per cent, of its 2,839,959,000-bushel crop to its principal diseases. In 1929, the crop and the "tax" were both smaller: 2,622,189,000 bushels, with an 8.5 per cent. loss. Another drop occurred in 1930: crop 2,081,048,000 bushels; plant disease loss 7.6 per cent.

Cotton stands next to corn in economic importance in this country. The 1928 crop of 14,373,000 bales was cut 2,432,000 bales, or 17.2 per cent., by the worst of the cotton diseases. In 1929 a crop of nearly 15,000,000 bales suffered a 14 per cent. loss. In 1930 the crop was only a little smaller than that of 1928, but its damage was considerably less—just short of 10 per cent.

Wheat, the third big-money crop when prices are normal, was taxed by its main fungus enemies to the extent of 7.8, 8.2 and 5.7 per cent., respectively, of its total yields during the period, which ran between eight and nine hundred millions of bushels.

Some regional losses, of course, naturally ran higher than the average for the country at large. This was not of country-wide importance in some instances; but when the great wheat state of Kansas lost by disease 9.75 per cent. of its 1930 wheat crop, while the national average was only 5.7 per cent., it was a matter of more than local concern.

The general average disease loss for the country as a whole, in the crops reported, ranged around the five to ten per cent. bracket. Thus, the 1930 loss in barley was 4.2 per cent.; in oats, 3.7 per cent.; in pears, 13.9 per cent.; in apples, 11.5 per cent.; in peaches, 4.5 per cent. Potatoes, however, seem to have more virulent enemies; their nation-wide loss in 1930 was 22.4 per cent.

The figures, as given in this report, are for plant diseases only; losses due to the inroads of insect enemies are not considered, since they are the concern of a different bureau of the Department of Agriculture. There are literally thousands of plant diseases, since every cultivated and wild plant has plant parasitic enemies ranging in numbers from single species to scores. Some of them are so subtle and stubborn in their attacks that whole groups of scientists have to specialize in dealing with one disease, just as doctors of human ailments do.

THE NATURE OF LUMINESCENCE

ORGANISMS that shine in the dark, like fireflies, and the bacteria that cause the light of "punkwood" or "fox-fire," have evolved this special ability from one of the biochemical reactions that underlie ordinary respiration. Reasons in support of this view were presented before the opening session of the American Philosophical Society's annual meeting at Philadelphia on April 21, by Professor E. Newton Harvey, of Princeton University.

Professor Harvey, who has been working on the problems of "living light" for many years, traced a close parallelism between the reaction of the glowing substance "luciferin" and oxygen, brought about by the enzyme "luciferase," and the "hydrogen acceptor" mechanism involved in the oxidation of food substances to set free energy in common non-luminous forms. The outstanding difference between the two processes is that in ordinary oxidation the end-product is carbon dioxide, whereas in the light-producing reaction this substance is not set free. Instead, the oxygen involved seems to be tied to hydrogen atoms to form water, and the oxidized luciferin is later caused to lose its oxygen and thus to be ready for use all over again.

Luminescence is a capacity possessed by many organisms scattered all over the evolutionary family tree; which leads Professor Harvey to believe that the shift-over from ordinary respiration to the special case of luminescence has occurred many times, and is not confined to any one line of descent.

There are two main modes of luminescence: continuous glow, exhibited by bacteria, and intermittent glow, exhibited by practically all other organisms. The intermittent type is the one most familiar to the majority of people; it is well exhibited by the common firefly. Intermittent luminescence ordinarily takes place only in response to a stimulus. It may serve an evolutionary end, such as scaring off enemies or attracting prospective mates. The anatomical mechanisms for its production are often quite complex.

The continuous glow of bacteria is emitted without stimulus and apparently serves no useful purpose to the organisms that display it. It seems to be produced

simply by the secretion of luciferin within the bacterium's body, and the oxidation of this luciferin when it makes contact with the air.

THE EFFECTS OF VOLCANIC ERUPTIONS ON THE WEATHER

SOUTHERN South America may get a cold, wet summer as a result of the volcanic eruptions now in progress in the Chilean Andes, if the experience of North America twenty years ago is any criterion.

In 1912, one of the greatest of the Alaskan volcanoes, Katmai, literally blew its top off, hurling vast quantities of fine volcanic ash high into the air. This drifted in the upper atmosphere, the particles serving as nuclei for cloud particles. The result was that over huge stretches of territory in the United States proper the sun was hardly seen at all that summer.

A few days after the eruption, showers of the ash itself fell at Victoria and Vancouver, in British Columbia, 1,300 miles away, just as ash showers from the Andean volcanoes have been falling in cities on the Atlantic side of South America.

The after-effects of the Katmai eruption were confined to the Northern Hemisphere, and disappeared within a year or so. But a generation earlier, in 1883, there was an eruption whose effects were noticed all over the world, and lasted for several years. This was the explosion of the East Indian volcano Krakatau, which destroyed over 36,000 lives. This eruption threw so much ash—estimated at 4.25 cubic miles—so high into the air that it drifted entirely round the earth, and is credited with causing the unusual red sunsets that were observed for several years after the eruption.

Whether the present South American outbreak will have any such effects as these will depend largely on how high the volcanoes are casting their ash vomitings. If they get any large quantity of ash above the level of the highest clouds, about ten miles up, it may drift indefinitely, cross the equator and make its effects felt in the Northern Hemisphere, said Professor W. J. Humphreys, of the U. S. Weather Bureau, in response to a *Science Service* inquiry. At a somewhat lower elevation, the ash will still drift, but, caught in the Southern Hemisphere air circulation, it will not invade the supra-equatorial lands. And if the ejecta are not cast above cloud level, Professor Humphreys continued, they will be caught by condensing water and soon be washed entirely out of the air.

Although volcanologists themselves freely use the term "volcanic ash," they are careful to point out that it is not an accurate usage, if by "ash" one understands material that has been exposed to fire. For there is no fire in a volcano, except such small incidental flames as are caused by the ignition of minor amounts of inflammable matter such as hydrogen and sulphur. The appearance of great flames above the volcano is caused by the reflection of the glowing lava on the clouds above; and the "ash" is simply lava that has been blown into fine froth and finally shattered into particles by the explosive action of the eruption.

ROTENONE

ROTENONE, most effective insect killer yet discovered, has yielded the secret of its chemical make-up to three chemists of the U. S. Department of Agriculture, Dr. F. B. LaForge, Dr. H. L. Haller and Mr. L. E. Smith.

Rotenone is a white crystalline substance, obtained from the roots of tropical plants belonging to the pea family. Its principal commercial source at present is the East Indian vine, derris; but a South American shrub, cubé, has also been shown to contain it in paying quantities.

Rotenone contains only three chemical elements, carbon, hydrogen and oxygen, in the ratios of 23, 22 and 6. This is expressed by the "linear" formula $C_{23}H_{22}O_6$. The "structural" formula, which shows organic chemists just where each atom of the molecule is located, is reported to be quite complex.

The three chemists who conquered rotenone's secret are referred to by Dr. C. A. Browne, assistant chief of the Bureau of Chemistry and Soils, as winners over keen competition by German and Japanese chemists, who also were hard on the trail of its formula, and had been working for some time before the Americans started.

Chemists always want to know the exact formula of a compound that has been found valuable, because then they may be able to learn how to put it together more cheaply out of coal tar or some other low-priced material, instead of extracting it from expensive imported plant sources. The three chemists are now at work on this problem, and have already succeeded in assembling several compounds that might be said to represent half-way steps in the reconstruction. There is, of course, always the possibility that some entirely new synthetic product may be put together that will be even better than the natural prototype. This has happened frequently in the history of organic chemistry. The three Department of Agriculture chemists naturally hope that they may have a similar success.

Rotenone, for all its present highly scientific exploitation, was originally a gift to white men by naked savages. In both the East Indies and in South America the plants containing it were used as fish poisons, to kill fish wholesale in dammed-up little rivers. Though poisoned, the fish were still good to eat.

White man tried the poison on himself and on warm-blooded animals and found it harmless. He tried it on insects, and found it killed them with amazing quickness and economy. Now rotenone is used on a large scale in many widely-advertised insecticides. It is in the hope of making cheaper and better insect-killers that the Department of Agriculture chemists are carrying on their research.

ITEMS

BOTH neutrons and gamma-rays are given off when the metal beryllium is bombarded with the hearts of helium atoms, Dr. F. Rasetti, of the Kaiser Wilhelm-Institute for Chemistry, Berlin, has concluded after repeating the experiments of Drs. W. Bothe and H. Becker, German physicists, Mme. I. Curie-Joliot and Professor F. Joliot, French experimenters, and Dr. J. Chadwick, of Cambridge, England, which had been interpreted both as artificial radioactivity and as demon-

strating the existence of the neutron, close combination of electron and proton. The neutrons are detected most readily in an ionization chamber and the gamma-rays, like those from radium, are detected by a counting tube.

CHEER for persons suffering from high blood-pressure was given by Dr. Carl J. Wiggers, professor of physiology of Western Reserve University School of Medicine, in an address before the American College of Physicians. High blood-pressure, he said, must be looked upon as a compensatory reaction designed to restore a normal blood supply to the tissues of the body. According to Dr. Wiggers, "If the physiological conception that hypertension is nature's agent, assuring an adequate blood supply to the tissues, could gain firmer root in the doctor's mind and through him be relayed to his patient, it would do much to remove the feeling of despair and impending doom so common in the layman who learns that his blood-pressure is 'high.'"

NEARLY sixteen years before the ninth planet, Pluto, was discovered, it was photographed at Harvard College Observatory. Its image has just been found on a photographic plate by Miss Arville D. Walker after Dr. E. C. Bower, of the University of California, had computed where the planet should have been on the night of November 11, 1914, when the plate was exposed through the 16-inch Metcalf telescope at Cambridge, Massachusetts. Pluto was discovered at Lowell Observatory, Arizona, early in 1930.

THE heavenly object discovered in March by Professor E. Delporte, Belgian astronomer, may be the return to the solar system of the Tuttle-Giacobini comet seen in 1858 and 1907. This is suggested by Dr. A. C. D. Crommelin, now that the orbit of the Delporte object has been computed. Comets known as 1858 III and 1907 III were not immediately recognized as identical. If the Delporte object proves to be the same comet, it must have lost most of its gaseous envelope since 1907, because it looked more like a star than a comet when first found, although it moved rapidly as comets do. It was bright when first found but faded shortly thereafter although it was approaching the earth and sun. It is suggested that there must have been some kind of outburst to explain its temporary brightness.

DISCOVERY of two substances that affect profoundly the growth and activity of female sex organs has been reported to the French Academy of Sciences by Drs. André Girard and Georges Sandulesco, of the Roussel Research Laboratories, Paris. These substances are described as new sex hormones in addition to the remarkably active substance known as theelin, the female sex hormone which was discovered by an American, Professor Edward A. Doisy, of St. Louis University School of Medicine. The two hormones belong to the same chemical group, the oxy-ketones, which means that they are related to acetone and alcohol, or, rather, phenol. They differ only slightly in composition. They all contain the same quantity of carbon and oxygen in their molecule, namely, eighteen carbon and two oxygen atoms, and differ only in the number of hydrogen atoms in the molecule.

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SCIENCE NEWS

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THE SUN'S CORONA DURING AN ECLIPSE

THE shape of the sun's corona, which is the aureole of pearly light visible only during a total eclipse, is closely related to the number of sun-spots, but runs ahead of them by about two years.

This, in rough brief outline, is one of the results of observations on the "Tin Can Island" eclipse in 1930, which has been worked out by Professor S. A. Mitchell, director of the Leander McCormick Observatory of the University of Virginia, who reported his researches before the annual meeting in Philadelphia of the American Philosophical Society.

The coronal shape seen at eclipses when sun-spots are at their lowest number characteristically shows two long wings streaming out on either side of the sun along the equatorial region with shorter brushes projecting from its polar regions. The startling thing about the 1930 corona was that it showed this shape in spite of the fact that the next minimum in sun-spot numbers is not expected until 1934. This was all the more surprising for the reason that the corona at the preceding year's eclipse had shown the shape characteristic of sun-spot maximum.

The most interesting result of Professor Mitchell's 1930 observations, however, was further evidence concerning the existence of the element "coronium" on the sun. Analysis of light from the corona by means of the spectrograph has shown numbers of bright lines. Some forty lines, however, were at first unidentifiable, and were supposed to be due to an unknown element which was given the provisional name "coronium," just as helium was similarly identified by the spectroscope on the sun before it was known on earth.

However, it has now been shown that 22 of the 40 lines are caused by high-level lines in the sun's atmosphere called the chromosphere and hence can be traced to elements known on earth. The origin of the remaining 18 lines provisionally ascribed to "coronium" still remains one of the astronomical mysteries.

The eclipse expedition of 1930 was known as the "Tin Can Island" expedition because that is the nickname for Niuafoou Island, the only available land in the wide Pacific Ocean where the eclipse was total. The island received the name because the only method whereby its mail is delivered from passing steamers is by its being sealed in a big tin can which swimmers from the island bring ashore.

INVESTIGATION OF COSMIC RAYS AT THE FRANKLIN INSTITUTE

STUDIES of the mysterious cosmic rays that continually bombard the earth from outer space, in order to determine the direction from which they come, to detect individual rays and to measure their energy, were described on April 20 to members of The Franklin Institute by Dr. W. F. G. Swann. Dr. Swann gave his annual report on the work of the Institute's Bartol Research Foundation, of which he is director.

He told of the cosmic ray "telescope" which he has recently developed. This device consists of two steel spheres at the end of a steel support. A large cylinder of lead is between the spheres, which contain gas. When the cosmic rays enter the spheres, the gas is "ionized," and it becomes a conductor of electricity. If the rays hit the telescope on the side, the two spheres receive an equal amount of the radiation. The adjustments are so made that the effect is that one sphere will just neutralize that in the other. But if the rays come in line with the telescope, the lead cylinder shields the sphere farthest from the source of the radiation, and the effect is less at that end.

Dr. Swann also told of an improvement in the "Geiger counter," a device for detecting cosmic rays, that has been made by his colleagues, Drs. Thomas H. Johnson and J. C. Street. This apparatus, as used in the past, consists of a metal cylinder, in the center of which is a wire, and which is itself enclosed in a glass tube filled with gas. Between the wire and the cylinder is maintained an electrical potential of 1,500 volts. Though the gas acts as an insulator, and the current can not flow from the wire to the cylinder, a single cosmic ray is enough to break down its insulating properties. Then the electricity passes through, and the discharge may be recorded. Because the gas must be just on the point of breaking down, and passing the current, the counter is apt to go off accidentally, without a cosmic ray being present. Also, after the counter has once operated, it takes a short time for the apparatus to recover, and to be ready for the next ray, so that some may be missed, if they come too rapidly.

Drs. Johnson and Street, the speaker explained, have produced counters which recover ten times as rapidly as those formerly used, and which are practically free from disturbances caused by the electrical discharges when they are operated. Dr. Swann said that the same counting rate has been obtained day after day, and that this indicates the reliability of the device. He said that their rate is such that one ray will pass through every square centimeter on the average of once every 137 seconds.

Other experiments at the laboratory have to do with the killing effects of x-rays. Cells of *Euglena*, a microscopic plant, were used in experiments by Dr. Swann and Dr. del Rosario. It has been thought that the killing effects were dependent on the absorption of the rays, and that if more were absorbed the killing would be more complete. But they find that some of the rays are more deadly than they should be. This, they suggest, is due to a sensitive entity in the cell, and they have determined its size, if it really does exist.

Still other experiments, by Dr. C. T. Bainbridge, have had to do with isotopes. At one time it was supposed that the atoms of a single chemical element were all of a single weight. However, it was found some time ago that various elements consist of isotopes, which have

atoms of different weights though they are the same element. Dr. Bainbridge has discovered three new isotopes of the element tellurium. He has also determined those in zinc, and has shown that some affects previously supposed due to zinc isotopes were really the result of hydrogen as an impurity.

THE DELPORTE OBJECT

A SMALL point of light in the heavens is pronounced by Dr. Fred L. Whipple, of the Harvard College Observatory, to be "the most interesting and puzzling body of the solar system since the discovery of Pluto." It is the Delporte object discovered by Professor E. Delporte, the Belgian astronomer, on March 9.

It has kept the astronomers of the world guessing as to whether it is a comet or an asteroid. Dr. Whipple and L. E. Cunningham, after computations of two sets of elements to determine its path in the heavens, are of the opinion that it is a comet and possibly identical with Comets 1858 III and 1907 III. Further computations of the influence of the earth upon the object must be made to determine whether the Delporte object is actually this older comet on a return to the vicinity of the earth.

"The very rapid motion, 2.5 degrees per day, and faintness indicated a very close approach of a small object naturally suspected of being an asteroid because of its stellar appearance," said Dr. Whipple. "Its orbital elements were very difficult to determine accurately even from an apparent arc of fifteen degrees because its motion was nearly in a great circle. No comet or asteroid can move in this fashion for any length of time, but the peculiar coincidence of position in the sky and plane of orbital motion enabled the Delporte object to move fifteen degrees in a great circle with a deviation of only a minute of arc for about six days.

"The orbital elements when more accurately determined were on the border-line between asteroid and comet, appearing, however, more asteroidal than cometary. The eccentricity of 0.5 and period of approximately three years are distinctly those of an asteroid although the orbit plane and perihelion distance are very similar to those of the comets of 1907 III and 1858 III. A period of about three years as computed by Cunningham and myself would indicate that the body, without being observed, had passed perihelion seven times between 1907 and 1932, in case it is identical with 1907 III. This seems perfectly possible because at its opposition the body was rather faint (magnitude 13) when observed at a distance of only 0.92 astronomical units. The distance from the earth would have been much greater at other perihelion passages. It seems less probable but still possible that the object was not observed between 1858 and 1907, in spite of the greater brightness in past years, this possibility being due to the rapidity of its motion at opposition.

Professor Van Biesbroeck, of the Yerkes Observatory, states that on April 5 the object had decreased in brightness to the fifteenth magnitude from the thirteenth magnitude late in March. This behavior is characteristic of a comet and not of an asteroid.

LEAVES OF PLANTS ARE BEST GAS DETECTIVES

POTTED tomato plants can give warning of gas leaks, long before even that most sensitive of animal detectives, the canary, could detect them. This is one of the possible uses for the peculiar behavior of plants in the presence of ethylene gas that was suggested by Dr. William Crocker, of the Boyce Thompson Institute for Plant Research, speaking at one of the closing sessions of the American Philosophical Society's meeting in Philadelphia. Plants could also be used to detect dangerous gases in garages and other closed spaces where men are at work.

The value of many plants, and especially the tomato plant, for this purpose depends on the curious behavior of their petioles or leaf-stems in the presence of very dilute quantities of ethylene gas, which is a common ingredient of illuminating gas and is also almost invariably present when the poisonous carbon monoxide is being generated. Dilutions of ethylene as low as one part in ten million of air will cause tomato leaf-stems to begin growing on the upper side where they did not grow before, thus causing them to bend downward instead of up. This effect was first demonstrated several years ago by Sarah L. Doubt, and has since been the subject of much research by Dr. Crocker and other plant physiologists.

Curiously enough, if a potted plant is turned upside down and then exposed to ethylene, it does not react. It behaves as though it were confused, not knowing which way to turn. The secret of this lies in the fact that the growth direction of the leaves is really a response to the pull of gravity, and the ethylene, by anesthetizing the plant, destroys its ability to respond normally to this stimulus.

Not all plants are sensitive to ethylene, however. Dr. Crocker mentioned the common Boston fern, which remained unaffected by the gas in atmospheres containing 90 per cent. of it. On plants sensitive to its action, ethylene has a whole series of effects, which Dr. Crocker and his associates have studied. Among other effects, it produced a slowing down in the rate of growth in length, it brought about a destruction of chlorophyll in rose leaves, it caused leaves to fall off from many plant species. In smaller concentrations it has been used commercially for a number of years in the artificial ripening of many fruits and vegetables.

DECREASED APPROPRIATIONS FOR THE BUREAU OF STANDARDS

DECREASES in appropriations for the Bureau of Standards are planned and expected to go through as follows: Salaries, \$65,000 from \$710,000; equipment, \$8,000 from \$88,000; general expenses, \$8,000 from \$68,000; improvement and care of grounds, \$5,400 from \$17,400; testing structural materials, \$48,200 from \$318,200; testing machines, \$6,700 from \$51,700; investigation of fire-resisting properties, \$7,320 from \$32,320; investigation of public utility standards, \$11,570 from \$101,570; testing miscellaneous materials, \$6,150 from \$46,160; radio research, \$8,000 from \$82,280; color standardization,

\$3,180 from \$15,180; investigation of clay products, \$5,160 from \$45,160; standardizing mechanical appliances, \$8,020 from \$48,020; investigation of optical glass, \$3,180 from \$25,180; investigation of textiles, \$7,100 from \$57,100; sugar standardization, \$7,520 from \$82,520; gage standardization, \$6,700 from \$46,700; testing railroad-track, mine and other scales, \$8,060 from \$58,060; high-temperature investigations, \$4,080 from \$10,080; metallurgical research, \$6,640 from \$56,640; sound investigations, \$3,140 from \$11,140; industrial research, \$132,860 from \$232,860; standardization of equipment, \$79,525 from \$229,525; standard materials, \$2,540 from \$10,540; investigation of radioactive substances, \$9,320 from \$29,320; utilization of waste products from the land, \$7,900 from \$47,900; investigation of automotive engines, \$7,760 from \$47,760; investigation of dental materials, \$4,940 from \$9,940; hydraulic laboratory research, \$11,000 from \$51,000; total cut from the Bureau of Standards, \$492,975, making total appropriation \$2,137,280 instead of \$2,630,255.

Other departments of the government requiring work from the Bureau of Standards may have it done by paying for it and similar provision will probably be made so that commercial firms may pay for work they want done.

THE FOREST SERVICE

OPPOSITION to President Hoover's reported plan to have the U. S. Forest Service transferred from the Department of Agriculture to the Department of the Interior will be voiced editorially in the forthcoming issue of *The Journal of Forestry*. The editorial will say, in part:

"Federal forestry is primarily a conservation measure and it is of great magnitude and most far-reaching effects. The Department of Agriculture, eminently successful in handling problems concerning the conservation of farm lands, has given an equally satisfactory accounting of its handling of forest land matters. By virtue of its policies, experience, tradition and the public spirit of its personnel, it is the most competent of the existing departments to administer the federal forestry work.

"The Department of the Interior is essentially not a conservation agency—never has been and was not created to function as such. It has been concerned principally with land disposal rather than the initiation of its wise use. Such forestry or conservation that it has been or is engaged in, is purely incidental or has been forced upon it.

"To place the Forest Service, charged as it is with the best and most constructive management of forest lands for the public, into a department which is traditionally unsympathetic to such use, is to make it an official stepchild and is too likely to endanger the very purpose for which the national forests were created.

"Unless the administration can offer a better way to reorganize and unify federal forestry work than to put it all in the Department of the Interior, we must insist that the Forest Service be left in the Department of Agriculture."

ITEMS

APPROPRIATIONS by the Congress for travel and for other funds have been materially reduced. Among those completely stricken out are the subscription of the U. S. to the International Prison Commission, \$4,088; participation in the Seventh International Conference of American States, \$80,000; contribution towards the maintenance of the Bureau of the Interparliamentary Union, \$7,289; contribution towards publication of annual tables of constants, chemical, physical and technological, \$500; payment of quota to support International Institute of Agriculture at Rome, \$5,400; the International Road Congress quota, \$3,000; the annual contribution of U. S. to International Society for Exploration of Arctic regions by means of airship for establishment of geophysical observations in inner Arctic regions, \$300; convention relating to the liquor traffic in Africa, \$55. For attendance at the World Radio Conference in Madrid, there will be available \$80,000 instead of \$90,000, and for the share of the United States in the International Fisheries Commission there will be \$25,000 instead of \$31,500. The United States will continue to support the Pan-American Sanitary Bureau, the International Office of Public Health, the International Hydrographic Bureau; the Gorgas Memorial Laboratory (\$40,000 instead of \$50,000 as in House bill); the American International Institute for Protection of Childhood; the International Statistical Institute at the Hague and the International Technical Committee of Aerial Legal Experts.

A NEW way of making photographic plates see very short ultra-violet light was reported to the American Physical Society at its meeting in Washington by Drs. A. J. Allen and R. Franklin, who are on the staff of the University of Pennsylvania and the Bartol Research Foundation. Ordinary photographic plates were coated with a solution of a special acid, called amino G acid. This left a durable layer of crystals that gave off bright blue light when the invisible ultra-violet light fell on them. The fluorescent light penetrated the photographic emulsion and thus recorded the very short ultra-violet radiation that can not produce the effect itself. Mineral oils that fluoresce have been used in the past for the same purpose.

RADIUM, x-rays, benzene and its various compounds, such as arsphenamine, are all known to produce injuries to the blood-forming tissues, especially the bone marrow, in certain doses and with certain susceptible people. On the other hand, these agents are used in the treatment of blood diseases. In a report to the American College of Physicians, Dr. Edwin E. Osgood, of the University of Oregon Medical School, reviewed the effects of these agents and the conditions under which they exert an action upon the blood-forming tissues. It was stated by Dr. Osgood that serious poisoning from these substances in the industries is not uncommon, but might be prevented by periodic blood examinations, elimination of the more susceptible individuals, reduction of exposure by local ventilation in benzene cases and the use of less toxic substances.

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SCIENCE NEWS

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APPROPRIATIONS FOR THE DEPARTMENT OF AGRICULTURE

THE McKellar amendments to the 1933 Agricultural Appropriation bill will be long remembered, particularly in the bureaus devoted primarily to scientific research.

Senator Kenneth McKellar, Democrat, of Tennessee, set himself to reduce appropriations for many of the department's scientific activities. He bitterly assailed all items which were labeled with particularly scientific-sounding names, and in most cases McKellar's amendments were sustained by the Senate and by the Senate and House conferees on the bill.

Among the reductions which bear Senator McKellar's name are the following: White-pine blister rust control, reduced to \$69,997 from \$469,997 in the House bill; foreign plant introduction, to \$28,325 from \$203,325; horticultural crops and diseases, to \$231,560 from \$1,431,560; phony peach eradication, to \$32,150 from \$82,150; rubber, fiber and other tropical plants, to \$38,932 from \$113,932; color investigations, to \$15,160 from \$90,160; wild plant improvement and weed control, to \$42,060 from \$56,260; fruit and shade tree insects, to \$47,645 from \$447,645; cotton insects, to \$72,820 from \$272,820; taxonomy of insects, to \$34,930 from \$234,930; pink boll-worm of cotton, to \$55,400 from \$430,400; gipsy and brown tail moths, to \$177,880 from \$577,880; Japanese beetle, to \$25,000 from \$375,000.

A table showing the 1932 appropriations in various agricultural bureaus devoted primarily or in part to scientific research shows the following probable line-up for 1933. Conferees on the bill have not agreed on certain of the Senate amendments to the bill at the present writing, therefore the department bureaus are unable as yet to predict what the practical results will be—that is, how the scientific personnel in the department will suffer, and so on.

	1932 Appropriations	Probable 1933 Appropriations
Office of Experiment Stations.....	\$ 399,410	\$ 294,294
Weather Bureau	4,497,720	4,164,038
Animal Industry	16,085,195	15,324,947
Dairy Industry	796,990	717,448
Plant Industry	5,839,238	4,941,094
Chemistry and Soils	1,947,201	1,825,086
Entomology	2,863,740	2,471,700
Biological Survey	2,229,170	1,756,177
Agricultural Engineering	583,840	518,690
Agricultural Economics	7,241,136	6,649,841
Home Economics	246,700	233,363
Plant Quarantine	3,747,930	2,490,125
Food and Drug Administration	1,810,228	1,716,167
Soil Erosion Investigations	330,000	289,160

THE CONQUEST OF YELLOW FEVER

YELLOW fever will claim no more martyrs among scientists seeking to conquer it, and in time it will cease to

be a dread peril to missionaries, explorers, business men and the general population in tropical sections of Africa and South America, as a result of the work of a research team of the International Health Division of the Rockefeller Foundation. Immunity can at last be given to protect people against this disease as it is given to protect against smallpox, diphtheria and typhoid fever.

Announcement of a successful method of protecting against yellow fever was made by Drs. W. A. Sawyer, S. F. Kitchen and Wray Lloyd, of the Rockefeller Foundation, at the meeting of the Federation of American Societies for Experimental Biology.

When Walter Reed, aided by brave volunteers who let themselves be bitten by yellow fever-infected mosquitoes, proved the rôle of the mosquito in carrying the disease, it seemed as if the conquest of yellow fever had been made. But it had only been begun. Yellow fever was cleaned out of the United States by warfare against the yellow fever-carrying mosquito, and it has been kept out by the vigilance of the U. S. Public Health Service's quarantine officers.

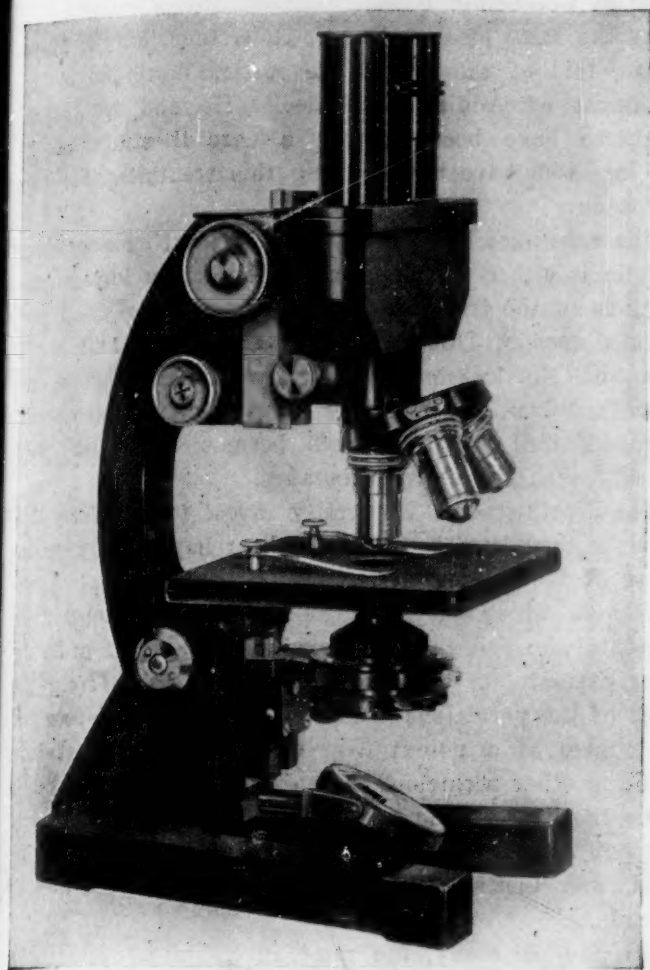
It still threatens in other parts of the world, however, and investigators have continued to work for years with the deadly virus or germ that causes it, in the effort to effect its final conquest. Fully as brave as Walter Reed's volunteers are these men who have carried on silently in their laboratories and in the tropics where yellow fever raged. Within the last four years thirty-two of them contracted the disease, five of them dying.

In Dr. Sawyer's own laboratory six members of his staff contracted the fever, but fortunately recovered. From these men he obtained the serum which, when injected with yellow fever virus recovered from mice, gives immunity to the disease in man.

The work hinges on a discovery of Dr. Max Theiler, formerly of Harvard University. It had never before been possible to give yellow fever to mice, but only to monkeys. Efforts to obtain a strain of the virus from recovered monkeys for immunization purposes were unsuccessful.

Dr. Theiler found that when he injected an irritating substance into the brain of a mouse at the same time that he injected the yellow fever virus, he could produce the disease in the mouse. When Dr. Sawyer heard about this he at once sent for Dr. Theiler to assist with the experiments he was conducting in laboratories provided by the Rockefeller Institute in a desperate effort to find a way of checking the disease that was taking such a dreadful toll of scientists and others.

Yellow fever virus from monkeys that have had the disease is too virulent to be used for immunization, but the mouse virus has been successfully weakened by passing it through two hundred mice. This weakened serum is then given together with serum from patients recovered from yellow fever. The two together give protection against the disease. The six members of Dr. Sawyer's staff who had contracted yellow fever in the course of their work furnished the serum for the first immuniza-



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tions, but Dr. Sawyer finds that it is possible to use serum from the immunized persons also.

It is now ten months since the first human beings were immunized in this way. By tests of their serum on mice, Dr. Sawyer finds that they still are immune. He has been able to test the serum of one of the original Walter Reed volunteers, and finds him also still immune, after thirty years.

The Rockefeller research team hopes that the immunity they are now giving will be equally lasting. It takes about seven to twenty-one days for the immunization to become effective. At the end of a year, they plan to re-test the sixteen persons immunized in their laboratories to see how much protection they will still have against the disease.

Sealed in glass tubes and frozen, some of the immunizing material was sent to Nigeria, in Africa, and to Brazil, where it was used successfully to immunize three other men. As yet not enough material has been produced to immunize large groups of populations, but some is already available for scientists, explorers, educators, missionaries, etc., going to yellow fever countries.

FUNCTIONS OF THE ADRENAL GLANDS

THE chief function of the vital adrenal glands is to regulate the body's use of sugar, Dr. S. W. Britton, of the University of Virginia Medical School, stated at the final session of the Federation of American Societies for Experimental Biology at Philadelphia.

These glands secrete two very powerful hormones: the familiar adrenalin, and cortin, which is now saving the lives of patients suffering from the once fatal Addison's disease. The part of the gland that secretes cortin is necessary to life. Dr. Britton thinks that it is through its control of the sugar metabolism that the cortex of these glands exerts its vital influence.

The sugar in the blood and the muscles and that stored in the liver is markedly decreased in amount when the adrenal glands are removed. In fact, removing the pancreas, which contains the insulin-secreting islands of Langerhans, and the liver, principal sugar storage organ, has no more critical effect on the sugar situation in the body than removing the adrenal glands, Dr. Britton said.

When the cortico-adrenal extract prepared by the method of Drs. Swingle and Pfiffner, of Princeton University, is given to animals whose adrenal glands have been removed, the animals recover, apparently through restoration of the normal sugar values in the body. Soon after giving the extract, the blood sugar returned to normal and even rose above the normal amount, at the same time that general symptoms of adrenal insufficiency disappeared. Cortico-adrenal extract also was found to increase the amount of sugar in blood, muscles and liver in normal animals.

Another group of investigators who produced an extract of adrenal gland cortex, Drs. Frank A. Hartman, Katharine A. Brownell and Julia E. Lockwood, of the University of Buffalo, reported experiments showing that the extract is necessary for the activity of various tissues of the body. This extract helps animals and men suffering from adrenal gland deficiency to resist fatigue, tox-

ins and cold, and gives the human patients an increased sense of well-being.

At the same session, Dr. C. H. Greene, of the Mayo Clinic, told of the use of the cortical hormone in the treatment of Addison's disease. He and Dr. L. G. Rountree have been making a careful study of 72 patients who have been getting this treatment for two years.

The substance in liver effective in treating pernicious anemia is either absent from or present in low concentrations in the liver of the patient suffering from pernicious anemia, Drs. A. C. Ivy, O. Richter and M. S. Kim, of Northwestern University Medical School, reported. When liver extract is given to pernicious anemia patients, the patients' livers become saturated quite rapidly with the active substance.

The Northwestern University investigators were able to make these discoveries, which bear importantly on the cause of the disease, as the result of an unusual opportunity in which they had human liver extracts, from patients who had received varying amounts of ordinary liver extracts, to work with. Extract made from the liver of the pernicious anemia patient who had received 42 ounces of a potent liver extract was successful in treating other pernicious anemia patients. Extract made from the liver of another patient who had received only a small amount of commercial liver extract before he died was ineffective in the treatment of pernicious anemia.

In another study, the same investigators found evidence that the substances stimulating the glands of the stomach to secrete the digestive juices may be of the nature of hormones and also of secretion-stimulating substances called secretagogues.

FEMALE SEX HORMONES

THE question whether there are many different female sex hormones, or whether there is one mother-substance giving rise to all of the recently-discovered female sex hormones, was raised as a result of reports to the Federation of American Societies for Experimental Biology. Drs. J. B. Collip, J. S. L. Browne and D. L. Thomson, of McGill University, described the hormones which they have obtained in pure crystalline form.

This hormone, called emmenin, they have obtained from human placental material and also from the kidney secretions of expectant mothers. It appears to be very similar in gross chemical structure to the hormone, theelin, already reported by Dr. E. A. Doisy and associates of St. Louis University; to trihydroxyoestrin, another female sex hormone, reported by Dr. Marrian, of University College, London, and by Dr. Butenandt, in Germany; and to a female sex hormone reported by Dr. Doehrn, of Berlin. But while these substances appear to be the same chemically, they differ somewhat in the effect they have on the animal body.

Dr. Collip and his associates reported that when their emmenin is tested on baby female rats, its potency is from ten to twenty times as great as when it is tested on the usual test animal, a castrated female rat. He raised the question whether the method of testing these hor-

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mones is responsible for the different effects they are reported to produce on the body. He also asked whether one of these very hormones which are already known might not be the mother-substance, the real female sex hormone itself.

The hormone extracted by the McGill University investigators has been used to treat cases of female disorders with generally good results. It has been successful in nearly three fourths of selected cases. Dr. Collip emphasized the fact that it should only be used in certain selected cases. For instance, it would not be suitable for disorders due to cancer or cysts.

ITEMS

CARRASCO's comet, discovered on April 25 by an astronomer of that name at Madrid, Spain, has been observed from the U. S. Naval Observatory by principal astronomer H. E. Burton. He sighted it with the observatory's 26-inch refracting telescope on the evening of April 26, shortly after word of its discovery was received from the astronomical clearing house at the Harvard College Observatory. The comet was photographed at Harvard College Observatory on April 13, an inspection of photographic plates has revealed. The comet has now been located by Heidelberg observatory, the U. S. Naval Observatory and on the Harvard photographs. It is faint and of twelfth magnitude. The observations made will allow the computation of its path from which astronomers will be able to decide whether it is likely to grow brighter.

AN earthquake of moderate severity occurred somewhere near the coast of Chile, in latitude twenty-six degrees south, at 2:55, on the morning of April 26, according to the indication of instrumental data from three seismological stations transmitted through *Science Service* and interpreted by scientists of the U. S. Coast and Geodetic Survey. The longitude could not be determined exactly from the data available, so that it is not known whether the epicenter was on land or under the ocean. The quake does not seem to have been connected in any way with the volcanoes that erupted recently, for these are several hundred miles farther south. The stations reporting were those of the Jesuit Seismological Association at St. Louis University, St. Louis, Mo.; Fordham University, New York, and Georgetown University, Washington, D. C.

MOTION pictures of the circulation of the blood vessels that nourish the heart muscle itself were shown by Drs. R. L. Stehle and K. E. Melville, of McGill University, Montreal, at the Philadelphia meeting of the Federation of American Societies for Experimental Biology. The pictures were made in connection with research into the question of whether the blood flows into these coronary vessels of the heart muscle when the blood has been pumped out of the heart chambers into the rest of the body, or when the heart is expanded to receive the blood from the body. Hardening of these coronary vessels is an important form of heart disease which scientists are trying to learn more about.

TINY flecks of hazy light around the borders of one of the most famous of the spiral nebulae, the one in the constellation Andromeda, are now believed to be great globular clusters of stars—literally swarms of suns crowded like clouds of gnats that hang over the marshes at twilight. This provisional identification was made by Dr. Edwin Hubble, of the Mount Wilson Observatory, of the Carnegie Institution of Washington, after a careful study of 140 objects. Their astronomical behavior led him to the conclusion that they are probably star clusters, similar to the easily identified clusters that belong to our own particular part of the starry universe. The Andromeda nebula is one of the most famous of these great "pinwheels of the sky," whose spiral structure can be discerned only by means of the most powerful telescopes. Although it consists of so many thousands of stars that the 140 probable clusters on its border are mere incidents of its structure, it can barely be seen as a bit of light by the naked eye. This is because it is so immensely distant from the galaxy to which our own solar system belongs. Its distance has been measured as 900,000 light-years.

HALF of the patients in hospitals for mental disease owe their illness to definite changes in the tissues of their brains brought about by chronic infections of teeth, tonsils, sinuses or digestive tract, in the opinion of Dr. Henry A. Cotton, director of research at the New Jersey State Hospital in Trenton. By eliminating the chronic infections in these patients, Dr. Cotton and associates were able to double the number of recoveries at the hospital during the last thirteen years. Two thousand instead of one thousand patients recovered during that period. Incidentally the state saved, for at least six years, \$1,000 a day for the maintenance of these patients, leaving out of consideration the large amount saved in cost of construction of a new building to care for that number of patients. In order to prevent the occurrence of mental disorders as well as many physical disorders Dr. Cotton advocates searching for and cleaning up chronic infections in children between the ages of twelve and fifteen.

A NEW kind of copper has been discovered by Professor Edna R. Bishop, of the Alabama Experiment Station, in a further application of the magneto-optic method of analysis which was recently used in the discovery of the new chemical elements virginium and alabamine. Professor Bishop was herself one of the discoverers of the new element alabamine. The new copper is an isotope differing only in weight from the usual type of copper atoms. Isotopes of weights 65 and 63 had already been discovered by Professor F. W. Aston, of Cambridge University, England. Analyses of copper salts from various sources and of different combining powers have all now shown a third isotope in the Allison apparatus. It is not yet possible to say what is the weight of the new kind of copper atom beyond the fact that it is less than 63. This discovery fits the prediction by Professor Harold C. Urey, of Columbia University, of a new copper isotope of weight 61.

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SCIENCE NEWS

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DISINTEGRATION OF ATOMS BY COSMIC RAYS

RADIATION from the depths of the cosmos with the greatest energy ever observed by man has been detected at the California Institute of Technology, Pasadena, by experiments performed by Dr. Carl D. Anderson under the direction of Dr. Robert A. Millikan.

With energies four hundred times that of the most intense gamma rays from radium and four thousand times that of the most penetrating x-rays used in cancer treatment, these cosmic rays of terrific smashing power are shown to rate a thousand million volts. There are no energies from processes taking place on earth that are more than eight million volts and no higher measurements had heretofore been made. These are from radioactive disintegration.

So large are these energies shown by about ten per cent. of the cosmic rays caught photographically in a new giant ray-track chamber that Dr. Millikan has added two possible hypotheses to his previous suggestions as to the cause of some cosmic rays. The apparent energies in a few of these rays are such as would be expected from the entire annihilation of a proton, the positive unit of matter, in the outer parts of the universe. Or equally well they may be signals of the synthesis of heavy elements of over atomic weight 100 out of hydrogen in distant cosmic spaces. If the latter idea proves correct, it means that silver, gold and other heavy elements are much more plentiful in the rest of the universe than they happen to be here on earth. A thousand million volts is just about the energy that would be given off if silver were synthesized out of hydrogen.

In making the first direct measurements of energies of cosmic rays Drs. Millikan and Anderson were searching for evidence of the nature of this penetrating radiation that has puzzled scientists for the last seven years. The question was: Are cosmic rays electro-magnetic waves, photons, or ether vibrations like light, x-rays and gamma rays, or are they neutron particles of high speed and energy, such as were suggested as a possibility in Europe recently?

By building a large "cloud chamber" in which cosmic rays rushing through moisture-charged air or gas leave a visible track of water droplets and by subjecting the chamber to an immense magnetic field that bends the cosmic rays, Drs. Millikan and Anderson have obtained evidence that the photon hypothesis best explains the cosmic rays and that they are probably of the same family as light and x-rays. No evidence for the neutron hypothesis was found.

A thousand photographs made with the apparatus secured the portraits of thirty-four cosmic ray tracks, with curvatures under the influence of the magnetic field that are less as the energy increases.

In his report to the National Academy of Sciences, Dr. Millikan said that the facts indicate that the cosmic rays are absorbed principally by the heart or nucleus of the atoms they hit rather than by the electrons that

circle about the heart of the atom. His photographs show cosmic rays that hit an atom releasing two other tracks, one negative and the other positive, indicating both positive and negative particles are sometimes thrown out of the nucleus when it is disintegrated. The photon hypothesis is upheld by the fact that the cosmic rays also hit electrons and act in the same manner as gamma rays, producing the well-known Compton effect, and give more energy than a neutron can give.

Nine out of ten of the cosmic rays entering the detecting apparatus have energy values corresponding to those to be expected from the hypothesis advanced by Dr. Millikan several years ago that they originate in the building of the more abundant elements in the depths of the universe. The cosmic birth cries of helium-atom-building would be only 27 million volts and would therefore be absorbed by the atmosphere of the earth and not reach the cosmic ray detector at Pasadena. But 116 million volt rays corresponding to oxygen-building, 216 million volt rays corresponding to silicon-building and 500 million volts corresponding to iron-building are detected.

These researches by Drs. Millikan and Anderson were carried on with the support of the Carnegie Corporation.

RADIUM IN OCEAN SEDIMENTS

RADIUM is more abundant in the sediments of the deep ocean bottom than it is in land rocks. The deep sediments have more than four times as great a radium content as the granitic rocks on land, and more than ten times as much as land basalts. The deeper the sediments, and the farther they are from shore, the greater their radioactive content. These are among the facts laid before the American Geophysical Union at its recent meeting in Washington by Dr. Charles S. Piggot, of the Carnegie Institution of Washington.

The samples of ocean-bottom sediments analyzed for radioactive elements are not at all numerous as compared with the land rock and earth samples similarly examined, but in so far as any generalizations can be made, the facts are as stated.

This accumulation of more highly radioactive deposits in the deepest and most remote places in the ocean may be having an appreciable effect on the course of the earth's geological history. For one thing, such deposits can well act as blankets to slow down the escape of the internal heat-energy of the earth.

A number of theories of probable sources of these radioactive deposits were examined and discarded by Dr. Piggot. He does not believe that they have been concentrated by living organisms and deposited by the down-sifting of their skeletons after they have died. While some organic sediments have high radium contents, on the average the non-organic red clay sediments are three times as radioactive. Neither in his opinion is the theory of submarine volcanism, with intense chemical action where water and hot magma are in contact, any more tenable. Such action would be more or less

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"spotty" in its effects, whereas radioactive sediments are found everywhere.

Recognizing that much research yet remains to be done on the question, Dr. Piggot inclines to the belief that the origin of the radioactive content ocean-bottom sediments is to be sought directly in the rocks of the earth's crust. These are worn or broken down into the fine particles that eventually settle on the bottom of the sea, some of them carrying all their original radioactive elements with them, others having a part of the original content removed by chemical processes occurring on the way. Where the sediments are mixed with the remains of minute organisms these latter probably tend to dilute rather than increase their total radioactive content.

FOOT AND MOUTH DISEASE IN CALIFORNIA

THE U. S. Department of Agriculture and the State of California have slaughtered some 12,000 hogs, in five herds at Guena Park, Orange County, known to be infected with foot and mouth disease or to have been exposed to it. The animals were driven into great trenches dug to receive them, shot down, covered with quicklime and buried. No cure is known for foot and mouth disease, and it spreads rapidly among any kind of hoofed animals; so immediate massacre and quick burial are the only known treatments.

Several times have different parts of the United States been threatened with this disease, which attacks human beings as well as livestock, and which is wide-spread in Europe, South America and other parts of the earth. Each time it has been stamped out by the same Spartan methods of mass killing and rigid quarantine of the areas known to contain the infected soil—for the virus lives for some time on the surface of the ground.

Dr. Rudolph Snyder, of the U. S. Department of Agriculture, is in charge of the federal forces in California; in charge of the California forces is Dr. J. J. King, state veterinarian. The invasion was first discovered by Dr. L. M. Hurt, who notified state and federal authorities. Positive diagnosis of foot and mouth disease was made by Dr. Jacob Traum, of the University of California.

In the background, in Washington, stands the chief of the bureau of animal industry of the Department of Agriculture, Dr. John R. Mohler. He has confidence, however, that Dr. Snyder will have the situation in hand; for Dr. Snyder had charge of the federal work during the California outbreaks of foot and mouth disease in 1924 and 1929.

It is not known how the present invasion broke into the country. It seems probable, however, that it was imported, for Orange County lies on the seacoast, between Los Angeles and San Diego counties, and within easy trucking distance of several seaports. The hogs were known to be garbage-fed; and it was garbage from a coastwise steamer from South America that started the 1929 foot and mouth disease epidemic. One encouraging feature in the present situation is found in the relative isolation of the two infected herds of hogs which have been destroyed.

GERMS AS THE CAUSE OF CHRONIC RHEUMATISM

GERMS as the cause of chronic rheumatism and vaccines to treat it were discussed by Dr. Reginald Burbank, of New York City, at the recent New Orleans meeting of the American Medical Association.

In some early investigations into the cause of this wide-spread and distressing disease which doctors call arthritis, Dr. Burbank and his associates found that the blood of these patients carried protective substances against several strains of streptococcus germs. Since these could only have been formed under the influence of the germ, the investigators decided that the germs must be present in the blood. By a special technique they obtained some of the streptococci, but found them to be not the usual virulent type but another less active one that had developed the ability to live without arousing active resistance in the patient's body.

Rabbits after getting injections of cultures of these organisms developed the same chronic disease of the joints that had afflicted the human patients. Various tests showed that the changes in the tissues of the rabbits, identical with those in rheumatic patients, were caused by the actual presence of germs carried to the joint by the blood from a focus of infection such as the teeth or tonsils.

The most effective means of treatment is a vaccine, Dr. Burbank said. Removing the teeth or tonsils, which are the most common foci of infection, may or may not be helpful in chronic rheumatism. If the germ causing the disease is already in the joint, as his investigations tend to show, removing the original source can not give complete relief.

In addition to the vaccine he recommended increasing the general resistance by diet, tonics and general constructive measures. He mentioned especially the beneficial effects of good posture, which improves circulation, decreases mechanical strain and increases general well-being. The intestinal tract is the most important secondary focus of infection, he said, so it is especially important to keep it in order.

TREATMENT FOR DRUG ADDICTION

PRELIMINARY studies which the U. S. Public Health Service has made of the sodium rhodanate treatment for drug addiction, which Professor Wilder D. Baneroff, of Cornell University, reported to the National Academy of Sciences as a "cure" for the condition, fail to confirm the claims of the Cornell investigators, it became known in Washington recently.

The U. S. Public Health Service has investigated the new treatment in about 20 cases at the Fort Leavenworth station which it is maintaining for the study of drug addiction in cooperation with the Department of Justice.

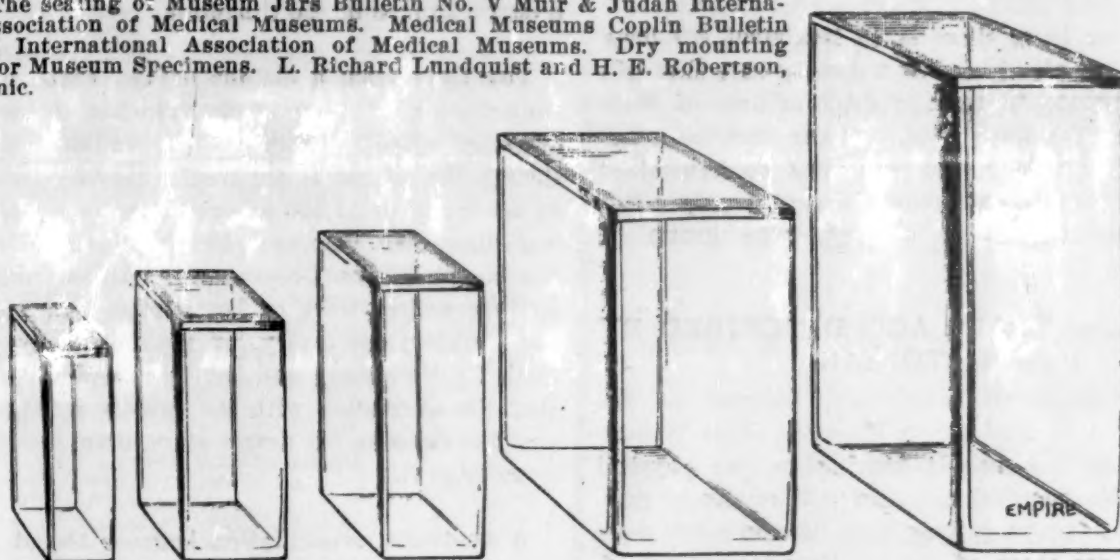
"Our experience there is not quite in keeping with Dr. Baneroff's," according to Dr. W. L. Treadway, of the U. S. Public Health Service, who is directing the drug addiction studies.

Dr. Treadway explained that because of the many factors entering into the problem of drug addiction and

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6211 Size number.....	1 2 2A 3 3A 4 5 6 7 8 9 10 11 12	1 2 2A 3 3A 4 5 6 7 8 9 10 11 12	1 2 2A 3 3A 4 5 6 7 8 9 10 11 12	1 2 2A 3 3A 4 5 6 7 8 9 10 11 12	1 2 2A 3 3A 4 5 6 7 8 9 10 11 12	1 2 2A 3 3A 4 5 6 7 8 9 10 11 12	1 2 2A 3 3A 4 5 6 7 8 9 10 11 12
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Price each	4.50 1.80 4.85 3.20 5.50 5.30 2.80 3.10 12.90 13.75 21.00 17.00	4.50 1.80 4.85 3.20 5.50 5.30 2.80 3.10 12.90 13.75 21.00 17.00	4.50 1.80 4.85 3.20 5.50 5.30 2.80 3.10 12.90 13.75 21.00 17.00	4.50 1.80 4.85 3.20 5.50 5.30 2.80 3.10 12.90 13.75 21.00 17.00	4.50 1.80 4.85 3.20 5.50 5.30 2.80 3.10 12.90 13.75 21.00 17.00	4.50 1.80 4.85 3.20 5.50 5.30 2.80 3.10 12.90 13.75 21.00 17.00	4.50 1.80 4.85 3.20 5.50 5.30 2.80 3.10 12.90 13.75 21.00 17.00
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its extreme complexity, he believed that any new treatment, such as Dr. Bancroft's, must take into account the necessity for more accurate knowledge concerning the chemistry of the opium alkaloids; more reliable information as to their effect on the human body and the exact nature of addiction; together with a satisfactory evaluation of the many psychobiological factors involving addiction about which we have little accurate, concrete knowledge.

"So far as we know there is no treatment for drug addiction from the standpoint of a specific cure that will miraculously operate to rid the drug addicts of their addiction," Dr. Treadway said. "Any treatment advocated for this particular purpose must be scrutinized with care and conclusions about it drawn only after months of experience with a very large group of patients."

HUMANS 75,000 YEARS AGO DESCRIBED BY PRE-HISTORIAN

PROFESSOR GEORGE G. MACCUDY, Director of the American School of Prehistoric Research, Yale University, writes that the records bearing on the physical characters of Neanderthal man are still relatively rare. But in the past few years they have become much more complete than are those of the pre-Neanderthal period, when such beings as *Eoanthropus*, *Pithecanthropus*, *Sinanthropus* and *Homo Heidelbergensis* existed.

Neanderthal man lived in the third inter-glacial and the early part of the fourth glacial epoch. In his physical make-up he retained many primitive characters, due to his branching from the main human stem as early as the Pliocene epoch. His lowly estate physically is even reflected in his kit of tools. Although a hunter, he never got so far as to represent by means of carvings, engravings or drawings in color the animals he hunted. This step was taken by his successor, the so-called race of Cro-Magnon.

The cable received from Theodore D. McCown, field director of the Joint Expedition of the American School of Prehistoric Research and the British School of Archeology at Jerusalem, said: "Three adult Mousterians surely Neanderthal, heavy brow ridges, taurodont dentition." This is said to be the greatest discovery of Neanderthal remains ever found. They are at a moderate estimate at least 75,000 years old.

The present is the fourth season of joint expeditions by the British and American Schools near the foot of Mount Carmel, during which time scores of thousands of artifacts, dating from the Mousterian and subsequent epochs, have been unearthed.

ITEMS

CANCER, it is claimed, can be detected by a serum reaction discovered by Dr. H. J. Fuchs, of Berlin. The reaction is based on the fact that fibrin from the blood of a person without cancer is broken down or digested by the serum of the blood of a person with cancer, with the production of some non-protein nitrogenous substances which can be detected by suitable chemical means. The method, as it was described by Dr. Fuchs, required special apparatus and some special training for the observer, which tend to prevent its general use.

Professor M. von Falkenhausen, of the University of Breslau, Germany, now reports a simplification of the method that may make it possible for other observers to test its validity. He has introduced into the reaction a colorimetric procedure which he states makes the method more exact and at the same time much simpler to carry out. He reports a series of eighty cases in which the reaction was used and in which there was not a single failure in the diagnosis.

THE light from a distant nebula, such as one in the constellation of Ursa Major, reaches the earth at the ordinary speed of about 186,000 miles a second, even though the nebula is apparently moving from the earth at a velocity of 11,500 kilometers per second. This fact was discovered last year by Dr. Gustaf Strömberg, of the Mount Wilson Observatory. It has been confirmed by independent work of Dr. George Van Biesbroeck, at the Yerkes Observatory, of the University of Chicago. Both Dr. Strömberg and Dr. Van Biesbroeck have found that the aberration with the rapidly receding nebula is just the same as for nearer stars, even ones that are approaching us.

A POSSIBLE reconciliation between the at present discrepant results of "ether drift" experiments has been presented to the American Physical Society by Dr. N. Galli-Shohat, of Bryn Mawr College. This famous experiment, known as the Michelson-Morley experiment for the men who first performed it, failed to show any positive evidence of the existence of an ether, and set a train of scientific investigations in motion that eventually led to Einstein's relativity theory. Later, Professor Dayton C. Miller, of the Case School of Applied Science, repeated the experiment, and reported positive results. Dr. Galli-Shohat claims to reconcile the disagreement by taking into account, not the earth's motion about the sun, but the motion of the whole solar system through space.

DR. W. J. HUMPHREYS, of the U. S. Weather Bureau, told the American Meteorological Society, meeting in Washington, that the melting of the great ice caps of the earth would raise the ocean level about 150 feet. Explorations of the past year, which determined by sonic sounding the average thickness of the great Greenland ice sheet to be about one mile, make possible a fairly accurate estimate of the height the oceans will rise. Dr. Humphreys said that there must be 4,000,000 cubic miles of ice on Greenland, the Antarctic continent and Iceland, which may be expected eventually to melt.

THE germs of typhus fever and of spotted fever are very much alike, but differ in the important respect of growing in different parts of the cells they invade, Dr. Henry Pinkerton and Dr. G. M. Hass, of Boston, reported to the American Association of Pathologists and Bacteriologists. The spotted fever germs grow and multiply massively in the nucleus of the cells, but infect the surrounding part of the cell only sparsely, they found from studying how the germs grow on animal tissues. Typhus fever germs, on the other hand, do not invade the nuclei of cells, but grow on the cytoplasm.

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LANDSLIDES IN THE RHONE VALLEY

THE whole valley of the Rhone River is subject to the danger of landslides similar to the one which engulfed part of the residential district of Lyon, France, Professor R. S. Bassler, head curator of geology at the U. S. National Museum, said in answer to an inquiry from Science Service. This is the second serious landslide which has occurred in this section of the French city recently. Both were caused by the geological formations in that locality.

Landslides are a constant danger where the ground is made up of loose rocks saturated with water and mixed with clay, which as any one knows can serve as a perfect natural skid as soon as it is well wet. The Rhone Valley is filled with deposits of this sort left by Ice Age glaciers and built up by the river in more recent times. Great terraces of clay built up all along the course of the river are a constant potential source of slides.

The Hill of Fourviere, where a serious landslide wrought havoc just eighteen months ago and near which the recent slide occurred, is a spur of granite on which such a moraine of rock and dirt was deposited by an ancient glacier. It is not now on the Rhone, but on the Saone River just above the point where it joins the Rhone. In early post-glacial times, however, both these streams were probably one huge torrent.

Just to the north of Lyon, the Saone was wide and spacious and formed the bed of an old lake. Later, a glacier, coming down from the Alps to the east, obstructed the drainage of this lake, leaving great piles of sand, gravel and clay in the vicinity of Lyon. Then the lake dried up forming marshes.

The area north of Lyon, known as the "Dombes," contained in the Middle Ages a large number of small lakes and ponds. This is a celebrated area which was cultivated by the monks. In recent times these have been drained, but the soil is still moist and forms a great fertile section.

Officials of the U. S. Geological Survey do not recall any landslide in the United States which has done material damage to a large city. One of the most destructive slides in this country in recent years was in 1925 at Gros Ventre, Wyoming, east of Jackson Hole. There a great avalanche of earth, rock and clay, topped by an entire pine forest, swept down from an altitude of 2,000 feet, went all the way across the valley and piled up 350 feet high on the other side of the valley. Then it slid back and formed a dam 250 feet high all the way across the valley. This dam formed a new lake four miles in length. Two years later, during the flood season, the waters of the lake rose and overflowed the dam and swept away the village of Kelly, in Jackson Hole.

Dr. Edwin T. Hodge, geologist of the University of Oregon, has discovered in that state a landslide topography where, in prehistoric times, whole mountains have moved a considerable distance.

THE NEARER ASTEROIDS

THE earth's closest neighbor in the sun's family, the Reinmuth object, discovered through Harvard computations, is one of the most important heavenly bodies discovered in recent years. Not since the discovery of the ninth planet, Pluto, have astronomers been so interested.

The Reinmuth object will come six million miles closer to the earth than the famous asteroid, Eros, discovered in 1898, which until a few weeks ago was known as the object that approached the earth closer than any other member of the solar system except the moon.

By a coincidence, it was found just a few days ago that the Delporte object, discovered the middle of March in Belgium, comes closer to earth than Eros, but the Reinmuth object's distance of eight million miles now breaks the Delporte object's record of ten million miles.

The asteroids are minor planets, most of which rotate about the sun in the wide gap of the solar system between Mars and Jupiter. More than a thousand asteroids have been discovered in that region and one theory is that they represent the remnants of a single planet that was spoiled in the making.

No asteroid has crossed within the orbit of the earth. If the Reinmuth object proves to be an asteroid and not a comet, it will be unique since the computations show that it will come within not only the earth's orbit but that of Venus as well.

This Reinmuth object, discovered by Dr. Karl Reinmuth on April 27, should not be confused with the "Reinmuth object" discovered by the same German astronomer last year and found to be a new member of the famous Trojan group of asteroids.

There is no hope that the interesting Reinmuth object, although comparatively close to the earth, will be seen with the unaided eyes. It is only about three miles in diameter and it is twelfth magnitude. Telescopes larger than six inches are necessary.

X-RAYS OF THE LIVER

PIONEER work in the use of a new method of diagnosing diseases of the liver and spleen was reported to the final session of the American Medical Association at New Orleans. The new method detected conditions which could not be determined by any other laboratory or clinical methods now in use, Dr. Wallace M. Yater, professor of medicine at Georgetown University School of Medicine, said in discussing the results of a study made by himself and his associate, Dr. Laurence S. Otell.

In using the new test, a small amount of a solution called thorium dioxide sol is injected into the veins every day for three days. On the fourth day x-ray pictures are taken of the liver and spleen. Ordinarily these important organs do not show up well on the x-ray plate, but after the thorium dioxide injections the shape of both spleen and liver may be clearly seen. In this way physicians will be able to tell whether these organs are enlarged, whether there is fluid in the abdomen, whether

such diseases as cancer, cirrhosis or syphilis of the liver are present, and whether a large mass in the left side of the abdomen is an enlargement of the spleen or a tumor of some other organ.

The substance which makes all this possible is a compound of thorium, a heavy metallic element related to radium. Thorium dioxide, however, has no radioactivity and is a perfectly safe compound to use. It was first investigated for this purpose by a German, Dr. Radt, of Berlin, in 1928. Two other foreign scientists have investigated it, but the Georgetown group are the first to try it in this country.

Being a foreign substance, the thorium dioxide is taken up by certain blood cells whose duty it is to fight infections and gather up foreign matter in the body. These cells are very much concentrated in the liver and spleen. When they are full of heavy, opaque thorium dioxide, they, and the whole organ, show up in the x-ray pictures, Dr. Yater explained. Because these cells are also present in great numbers in bone marrow the new method may be used for diagnosing disease of this substance and of intracranial disease.

Most valuable of the older tests for determining how the liver is functioning is the icteric index, which indicates the presence of jaundice by showing the amount of red bile pigment in the blood, Drs. William Egbert Robertson, William A. Swalm and Frank W. Konzelmann, of Philadelphia, stated at the same session.

UNITS OF HEREDITY

GENES, the ultimate units in heredity, have been seen and photographed, according to Dr. John Belling, biologist on the staff of the Carnegie Institution of Washington. This information has been made public by the institution at its headquarters in Washington.

Genes have hitherto been dealt with as hypothetical entities by biologists, because no one has ever actually seen them. They were like the atoms and electrons that make up matter: physicists treat them as actually existing things, though it is impossible to give them visual demonstration. But now Dr. Belling believes that he has brought the genes out of their invisibility.

All living cells contain structures that presumably contain genes—the chromosomes within the nucleus. But to get clear-cut pictures of chromosomes not all cells will do equally well. In the cells of some organisms chromosomes are too numerous or too small to work with conveniently; in others their outlines are not clear-cut.

Dr. Belling found lilies suitable for his purpose. By exceedingly fine and skilful microscopic technique, he got the contents of the pollen "mother-cells," each only one four-hundredth of an inch in diameter, emptied out on glass slides. By suitable chemical treatment he made the small divisions of the chromosomes, known as chromomeres, sharply visible. By further manipulation he was able to detect, within each chromomere, an exceedingly minute object which he takes to be the gene itself. A typical cell of the type Dr. Belling has been working with contains about 4,400 genes, arranged in 2,200 pairs.

In commenting upon the function of these structures, Dr. Belling says:

"A minute cell sphere with its 2,200 gene pairs suggests the celestial sphere visible to the unaided eye and containing fewer than 3,000 stars which can be seen at one time. These stars were supposed by some to exert a mystic influence on human beings. In the spherical cells of the organism, however, the genes actually do exert specific influences on the life of the organism in question, whether of the lily or of man. In fact these influences are so great that if the effects of all the thousands of genes in a given organism were added together nearly the whole of its inheritance would be accounted for.

"These strings of chromomeres are of more consequence, therefore, than the threads of life which, according to the old fable, the Fates were supposed to spin. Indeed, in many of the old sayings relating to the influences of the stars, if the term gene or chromomere be substituted for star the saying would hold to-day. Could we but identify every one of the chromomeres in a man (probably there are many more than in a lily), a reliable horoscope for him could be drawn up."

GRASSHOPPER OUTBREAK IN THE WEST

ON top of low prices, crop failures and general financial setbacks, another and more relentless foe is coming to plague the farmers this summer—grasshoppers.

Field surveys just made by representatives of the U. S. Bureau of Entomology confirm earlier predictions that with favorable weather, the country is soon to experience the worst grasshopper outbreak of the last half century.

Already throughout the West, young 'hoppers are about to waken from their winter's sleep and begin ravaging the farmer's crops. Reports from Texas and Oklahoma say that the insects have emerged from their membranous sleeping bags and started inroads on pastures, alfalfa and small grains.

As the focus of last summer's operations, south central South Dakota and north central Nebraska are expected to be most severely pillaged by the grasshopper. This year, in addition, the section comprising northeast North Dakota and northwest Minnesota is regarded as an equally important battleground. Iowa, Montana, Wyoming and Colorado form the secondary zone of conflict, while locally in almost every other western state insect forces will be encountered.

Grasshopper troops will begin general mobilization any day now, according to Dr. W. H. Larrimer, federal entomologist. A few days of warm weather is all that is necessary to bring them out in battle array. There will be far more grasshoppers this summer than last and the total area infested will be much larger than before.

The ill forboded in this statement is quite evident. Last summer in Nebraska and South Dakota alone, more than three fourths of the crops on 4,800,000 acres spread over 17,000 square miles of territory were completely destroyed, resulting in untold financial losses.

While the seriousness of a grasshopper plague is fully realized in the West, Dr. Larrimer said, several states are unable to meet the situation with their own resources.

Distributing poison-bran mash is the best known means of combatting the insects, but funds to procure the mash and spread it on the fields are lacking.

Battle plans of the U. S. Bureau of Entomology have been formulated, but can not be pursued until the Congress acts on a bill now before it. This bill, backed by President Hoover, provides a government appropriation of \$1,450,000 to buy the defensive poisons and make them available to the farmer this summer. The farmers themselves will then furnish an equivalent amount of labor for the spreading of the bran mash on the fields. The cost of protecting the crops against the devastating 'hopper is estimated to be about twenty to twenty-four cents per acre.

The wealth of the West can be preserved only this cheaply, Dr. Larrimer said, if Congress acts favorably on the bill within the next week or ten days. After that the grasshoppers will most probably be hatched and at work in the fields. The situation then will be beyond human control.

The peak of the damage done by grasshoppers will not be reached until July when the insects have wings and migrate in great swarms, but it is in May that protective measures are effective. The task of fighting the grasshoppers, Dr. Larrimer said, would be considerably lightened if nature were to inaugurate a spell of cold, wet weather for about two weeks after the bulk of the insects hatch. In that event, numbers of the 'hoppers would be destroyed.

ITEMS

THE amount of ultra-violet radiation needed to cure or prevent rickets is surprisingly small, Dr. Arthur Knudson, of Union University, Albany Medical College, found in studies with rats which he has reported to the Society for Experimental Biology and Medicine. Assuming that a similar relationship holds for human beings as for the animals he studied, Dr. Knudson says it appears that much smaller amounts of ultra-violet radiation than are generally considered necessary will be effective. The amount needed to cure rickets is directly proportional to the area of skin exposed. Thus exposure of one fourth of a square inch of skin for twenty minutes daily healed rickets completely in three weeks in the rats. The same result was obtained by exposing one square inch for five minutes, two square inches for two and one half minutes or one eighth square inch for forty minutes daily.

BIOCHEMISTS are producing hormones that are too pure, Dr. Joseph C. Aub, of Boston, suggested before the meeting in New Orleans of the Association for the Study of Internal Secretions. These highly purified extracts do not produce the practical results on patients that earlier, impure extracts did, he pointed out. He suggested that in the process of getting pure crystals of a hormone, the chemist may have broken down the natural compound and gotten a "degradation product" lacking some essential of the original one produced by the gland in the body. He also warned the physicians against laying too much stress on glandular treatment

alone and said there was no excuse for treatment with several glandular products at once.

ADVANCES in knowledge of epilepsy and a new theory as to its nature were reported by Dr. S. Bernard Wortis, of Columbia University and Bellevue Hospital, New York City, at the meeting of the American Medical Association. Dr. Wortis was able to cause epilepsy-like convulsions in cats by injecting a bromine-containing solution of camphor. Studying these cats, he concluded that very large doses of bromides would be necessary to secure good results in treating the disease, and that ether or chloroform would be useful in extreme emergencies. Operations to remove the adrenal glands or on certain nerves would not be a rational form of treatment for epilepsy, but removal of scars on the brain tissue resulting from injuries should be successful. Treatment by limiting the water intake or by feeding a high-fat diet will be investigated next.

MEASUREMENTS with the motion-picture camera of the time it takes the pupils of normal eyes to contract and to dilate were reported by Dr. Harry S. Gradle, of Chicago, at the meeting of the American Medical Association. He found that when light is flashed on a normal eye accommodated for the dark, there is a latent period of about one tenth of a second before the pupil starts to contract. Then, in a little over four tenths of a second, the pupil jumps to its maximum contraction. When the light is removed, the pupil starts to dilate at a uniform rate. In making his studies, Dr. Gradle was obliged to use young, blue-eyed, blonde persons, because the dark irises of brunets did not photograph clearly enough.

PHYSICIANS will be better able to diagnose certain diseases of the eye and to discover hardening of the arteries with the aid of a new instrument which was demonstrated by Dr. Jonas Friedenwald, of Baltimore, at the meeting of the American Medical Association. By applying certain principles used in modern microscopes to give sharper images, Dr. Friedenwald was able to develop this improvement on the instrument which is called the ophthalmoscope and which was originally invented by Helmholtz seventy-five years ago. This instrument enables physicians to see the back of the eye, and with the new improved model they can now see much earlier stages of disease and much earlier changes in the blood vessels. The difference between the new instrument and the old is much like the difference between using the high-power and the low-power lenses of a microscope.

BETWEEN three and four out of every hundred individuals, whether men, mice or rats, are "sensitive" to sulfhydryl, the chemical group consisting of one atom of sulphur and one of hydrogen, which has been called the key-compound to life itself, Dr. Stanley P. Reimann, of the Lankenau Hospital Research Institute, reported to the recent meeting of the American Association of Pathologists and Bacteriologists. The discovery that certain individuals are "sensitive" to sulfhydryl may throw light on many problems of cell division.

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A DISEASE SUPPOSED TO BE DUE TO GRAIN

GRAIN from certain sections of the great cereal-growing region of the Northwest seems to harbor the cause of a serious and sometimes fatal disease afflicting farm animals and possibly also human beings. Researches indicate very strongly that when several different kinds of grain raised in parts of the region are fed to laboratory animals, these suffer from a serious weakening of the bones, breakdown of the liver tissue, hemorrhage, skin disturbances and other symptoms. There are also indications that farm animals get the disease from eating hay as well as from the suspected grains. A few human cases showing somewhat comparable symptoms have been reported from hospitals.

The actual cause of the disease is still quite unknown. Conjectures have been made that it may be a fungus harbored by the grains, a bacterium or a poison drawn from the soil or formed in the grain because of peculiar soil or climatic conditions. But these are only guesses, and the real answer must await more extensive investigation. Investigators at the U. S. Department of Agriculture expect to grow grain under controlled conditions in the areas from which the disease is reported. They will feed this grain to experimental animals to obtain more definite data than are now available.

The four grains known to carry the disease are corn, wheat, barley and emmer. The latter is a relative of wheat, and seems to have been the first grain cultivated by the ancient civilizations of Babylonia and Egypt. It is less grown now, but is still valuable in many semi-dry regions.

Efforts will also be made to determine whether the malady is confined to specific soil types. If this proves to be the case, an effort will be made to find what soil elements or conditions are responsible for the trouble.

Before grains were pointed out as responsible for the disease, a very careful checking up was made. Large numbers of rats were fed on grain from the suspected area, and "controls" were fed from grain raised elsewhere. The controls remained healthy, while the others showed marked slowing down of growth, together with other abnormalities.

Trouble with poultry in the "poison area," apparently traceable to the same disease-bearing grains, manifests itself largely in the failure of eggs to hatch. The chick develops, almost reaching the point of hatching; some of them do hatch in a lame sort of way. But when the chicks, living or dead, are freed from the shells, they are seen to be cripples, with deficient leg or wing bones, sometimes with abortive beaks, and invariably clad in a thin, stringy, hair-like growth instead of the normal thick, soft down.

The experiments have been going on for more than a year until there is little doubt that the four grains named are real bearers of the disease. It is reported that local buyers have long been discriminating against

grains from the affected area. If this practice should become extensive, the economic consequences are bound to be very serious. It remains to be seen whether flour and other mill products made from the grains will produce nutritional disturbances in human beings.

The condition responsible for the present investigation seems not to be strictly new. Records of similar disturbances have been found running back for many years, into early exploration days; but until the present time the malady was merely shoved aside as "alkali trouble" and was not seriously considered.

RESISTANCE TO INFANTILE PARALYSIS

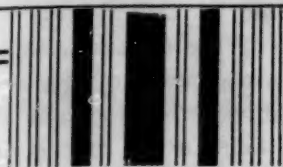
ARE resistance and susceptibility to infantile paralysis inherited? This question was raised at the recent meeting of the American Medical Association in New Orleans. The dread scourge of childhood which afflicted some five thousand young persons in last year's epidemic will eventually be controlled by increasing the resistance of the individual child to the disease. This was the hope held out to the general practitioners, the family doctors of the country, by leading investigators of the disease. Efforts to control the disease by preventing the spread of the germ or by fighting the disease itself will be less successful.

Investigating why some children get the disease and others do not, Dr. W. Lloyd Aycock, of Boston, found that it tends to "run in families." He reported a number of families in which the disease occurred more than once, affecting a second child some years after the first one had recovered. He cited particularly the cases of two brothers, orphaned at an early age and reared apart, both of whom developed the disease, indicating a possible hereditary factor.

Nearly nine tenths of affected muscles in cases of infantile paralysis were restored to normal within two years by proper care and exercise. This was brought out in a discussion of the importance of early careful treatment, to prevent the weakened muscles from stretching. These muscles were in "good" condition at the start of the treatment. About two thirds of muscles classed as only "fair" were restored to normal, while more than half of those classed as "poor" became normal.

The types of braces and supports used in keeping the paralyzed muscles at rest to prevent their stretching were shown at an exhibit sponsored by the American Medical Association and the U. S. Public Health Service. Taking part were Drs. Aycock, S. D. Kramer, James L. Wilson and Arthur T. Legg, of Boston; Edward B. Shaw, of San Francisco; John E. Gordon, of Detroit, and James P. Leake, of Washington, under the direction of Dr. R. C. Williams, of the U. S. Public Health Service.

Small infantile paralysis patients, of New Orleans, helped Miss Janet B. Merrill, of Boston, a "polio-therapist," show the physicians how to give just the right amount of exercise to the weakened muscles both



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Richard F. Flint
Assistant Professor of Geology
All at Yale University

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Part I of Textbook of Geology

Three years ago the writers of this new book helped revise Part I of the "Textbook of Geology" by Pirsson, Schuchert and Longwell. Extensive changes were made throughout, and several chapters were entirely rewritten; but as the revised book remained under the authorship of the late Professor Pirsson, the revisers felt an obligation to retain as nearly as possible the original method of presentation.

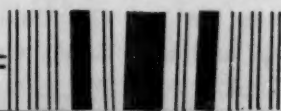
The present new volume embodies not only ideas of organization and presentation developed by the work of revision and by constant use of the revised text, but also much new material. The general order of the final revision is retained and in a few chapters some parts of "Pirsson's" scheme of presentation have been used, but only where they could be effectively adapted to the general plan of the present authors.

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in and out of water. Later in the week the disease will be the subject of a special symposium.

Poor posture as a cause of arthritis, or rheumatism, was cited in a discussion of this ancient disease, traces of which have been found in a dinosaur that lived one hundred and fifty million years ago. While there are other causes of the condition, this particular factor affects the function of the organs. Poor function of internal organs may influence the development of arthritis, according to the American Committee for the Control of Rheumatism.

PROTEIN-DIGESTING ENZYMES

PROTEOLYTIC enzymes, substances which are always found in mixtures in all animal and plant tissues, and which have the power both to break down or digest proteins and to synthesize or cause the union of different chemical substances, or to break them up into their constituent parts, were discussed by Professor Ernst Waldschmidt-Leitz, of the Institute of Chemistry, German Technical High School, Prague, who delivered the first of the 1932 Charles E. Dohme Memorial Lectures at the Johns Hopkins School of Hygiene and Public Health.

These enzymes are very complex, Professor Waldschmidt-Leitz explained. They are always found as mixtures, but he has developed methods of separating them and of proving the specific action of each separate enzyme. For example, years ago trypsin was thought to consist of a single individual ferment only. But Professor Waldschmidt-Leitz and his pupils have shown that the trypsin of an older day is not a unitary substance but consists in reality of six separate ferments, each of which plays its own individual rôle in the intestinal digestion of proteins.

The single enzymes which have been separated from the complex enzyme mixtures differ from each other in their chemical properties and each one has to be tested with special materials. Some of these enzymes or ferments split only substances with very large molecular weights, such as egg albumen, while others act only on substances of much smaller molecular weights. An example of the latter type of substance would be the amino acids or combinations of them which are found in all proteins.

The specificity of these various ferments is determined by their ability to attach themselves to certain chemical groupings of the substance upon which they act. The specific properties of the various enzymes when separated from the other admixed enzymes suggest an analogy to what is observed in toxin-antitoxin studies and call to mind the old side-chain theory of Ehrlich.

MENTAL DISEASE IN IDENTICAL TWINS

New light on the relative importance of heredity and environment as factors causing certain types of mental disease, and also juvenile delinquency and criminal tendencies, is gained as a result of a study of identical and non-identical twins being conducted at the University of Southern California by Dr. Aaron J. Rosanoff.

A total of one thousand pairs of twins with mental diseases is being sought by the scientist, and already

records of 404 have been obtained. This is believed to be the largest collection of such records ever gathered. A preliminary report of the data now available will be published in a forthcoming issue of *Eugenical News*.

Of those twins that were of the same sex and probably with origin in a single ovum, or egg cell, and therefore with the same hereditary equipment, 116 pairs had both twins affected and only fifteen pairs with but one individual affected, it was found by Dr. Rosanoff. An entirely different picture is presented by the group containing twins of opposite sex and therefore origin in separate egg cells with different heredity. Of these 26 pairs had both twins affected and 75 pairs where only one member was involved. Of the twins of the same sex, but probably non-identical, 53 pairs had both members affected and 67 had only one with the trouble.

The "disorders" considered included mental deficiency, epilepsy, dementia praecox, manic-depressive psychoses, and also behavior problems in children, adult crime and juvenile delinquency. As a check on these results, an associate of Dr. Rosanoff, Doncaster G. Humm, has undertaken a parallel study of brothers and sisters who are not twins.

CANAL PROJECTED FOR NORTHERN FLORIDA

THE construction of a great ship canal across northern Florida to save more than 800 miles, or three days' sailing time on a round trip between North Atlantic and Gulf ports, is urged in a report made by Colonel Gilbert A. Youngberg to the Florida Engineering Society following a preliminary study.

He believes that the project is well worth a complete survey of the site by army engineers. Colonel Youngberg's study, made for the City of Jacksonville, was authorized by the 1930 River and Harbor Act. A special board of engineers is now making a study of the most practicable route.

The canal would be one of the world's largest engineering projects. It is roughly estimated that it would cost between \$125,000,000 and \$200,000,000. Vessels plying between Gulf ports and northern Europe would be benefited almost as much as those going to or from the Gulf and North Atlantic American ports.

During 1929, Colonel Youngberg said, 1,487 vessels made 10,341 voyages that would have profited by the canal. These ships are the larger portion of those sailing from the Gulf, since only 1,971 vessels traded between ports on the Gulf and ports elsewhere.

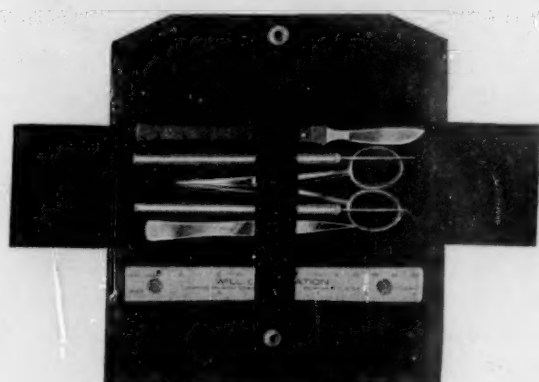
The immensity of possible savings in tonnage the new canal will effect was emphasized by comparison with freight now carried by well-known inland waterways. The ton-mileage savings of the projected canal will exceed 20,000,000,000 statute ton-miles.

"This is more than ten times the ton-mileage carried on that portion of the Mississippi River between St. Louis and New Orleans," Colonel Youngberg said. "It is more than 13 times that on the Ohio between its mouth and Pittsburgh, and it is about eight times the ton-mileage on the Monongahela, that paragon of inland water-way freight lines."

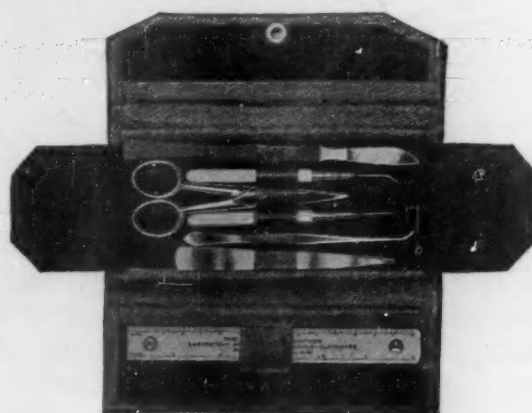
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The canal would be of great benefit to the American merchant marine, because, out of a total of more than 10,000 voyages which would have been benefited by the canal in 1929, 7,610 were made by American vessels and only 2,731 by vessels of foreign register.

ITEMS

No new herds of infected and exposed animals have been discovered in Southern California for several days prior to May 16 by the U. S. Department of Agriculture workers, and it is hoped that the outbreak may now be considered definitely at an end. Continued vigilance will, of course, be necessary for some time, to detect and stamp out promptly any cases that may occur.

AN asteroid or minor planet was discovered on May 10 at the La Plata Observatory, Argentine, the Harvard College Observatory has been informed telegraphically by Professor J. F. Hartmann, director. The new asteroid can not be seen by American astronomers as it is in the southern skies, in the constellation of the Hydra, right ascension 14 hours and south declination 22 degrees.

A TEST for determining the success of the new vaccine against yellow fever was discussed at the meeting of the American Medical Association. Drs. T. P. Hughes and W. A. Sawyer, of the Rockefeller Foundation, New York City, who just announced that they were able to give lasting protection against yellow fever by a newly-developed method that makes use of mouse serum, described the test. In this test the germ or virus of yellow fever is mixed with the blood serum of the person being tested and injected into mice. If the person has in his blood protective substances that guard against yellow fever, they will neutralize the yellow fever virus and the mice stay well. If the mice get the disease it proves that the person's blood lacks the protective substances and hence that he is susceptible to the disease. The specific nature of this test was proved by trying it on Canadians, who have never been exposed to yellow fever. As was expected, it showed that they did not have the protective substances.

SIXTEEN persons have been successfully vaccinated against yellow fever, Drs. W. A. Sawyer, S. F. Kitchen and Wray Lloyd, of the Rockefeller Foundation, have reported to the Federation of American Societies for Experimental Biology. This is the first time a way has been found to give immunity to this disease. While the method is not yet ready to be used on large groups of people in yellow fever countries, it can be used immediately to protect investigators working on the disease. Thirty-two yellow fever investigators contracted the disease within the last four years, of whom five died. Besides the sixteen successful vaccinations in New York, three men in Africa and South America have been given protection against yellow fever.

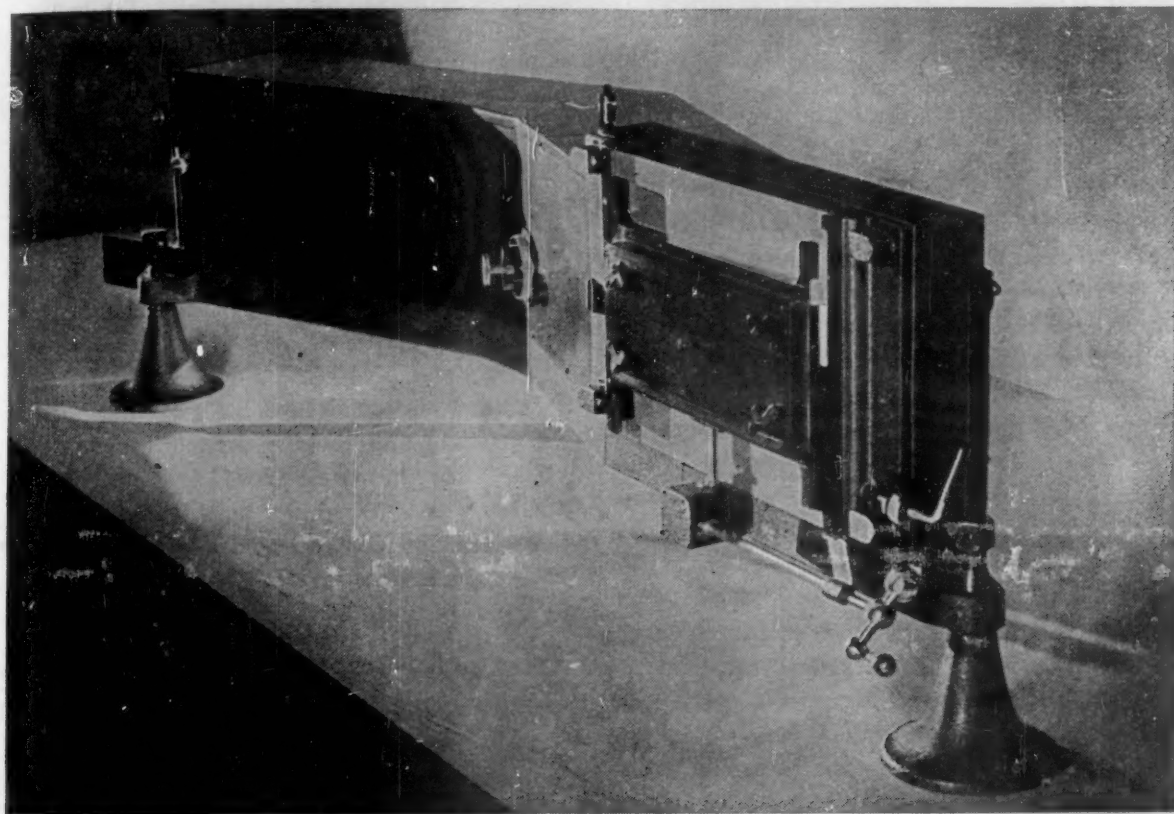
SCIENCE has not yet solved the green leaf's secret of storing up the energy of sunlight by converting carbon dioxide into carbohydrates, it appears from research by

Professor G. Mackinney, of the division of plant nutrition of the University of California. Vegetation has the ability of turning carbon dioxide, the gas exhaled by organisms and given off by fire, into carbohydrates, useful as starches, sugars and cellulose. Some six years ago Professor E. C. C. Baly, professor of chemistry at the University of Liverpool, reported the reduction of carbon dioxide to formaldehyde and carbohydrates in vitro, that is, in the test-tube. Others worked on the same important problem with varying success. Professor Mackinney has attempted to repeat the experiments, but has been forced to conclude in his report to the American Chemical Society that "no procedure has yet been published whereby conditions for obtaining formaldehyde and carbohydrates in vitro can be duplicated in other laboratories."

A QUARTER of the sufferers from the general paralysis type of insanity when treated with malaria have been practically cured and restored to former occupations, the U. S. Public Health Service announces in giving details of a new program of study of the treatment. Over ten thousand cases have been reported in the medical literature since 1917 when Professor von Jauregg, of Vienna, began to treat that advanced stage of syphilitic infection, known as paresis or general paralysis, with artificially inoculated malarial fever. A study of these reports shows that about 25 per cent. of patients have been practically cured and returned to their homes and jobs. Before the malaria treatment only one or two per cent. of the victims had complete remissions and patients died within three or four years. The U. S. Public Health Service is cooperating with the State Hospital at Columbia, S. C., in its new investigation. The development of reliable and simple methods of infecting the patients with malaria will be attempted.

PRODUCTION of vitamin A from the yellow pigment, carotene, by action of ultra-violet light is another step to understanding the essential food elements that a few years ago were totally unknown. Rapid progress has been made in the past few months in the chemistry of vitamin A. It is definitely known that carotene, such as used in the Cambridge University experiments, is the precursor of vitamin A. Other experimenters have shown that carotene is converted into the vitamin in the liver and early this year Professor J. C. Drummond, of University College, London, obtained vitamin A by splitting carotene into two products, one of which was the vitamin. Professor Paul Karrer, of the University of Zurich, Switzerland, recently derived a formula for vitamin A and showed it to be a close chemical relative to artificial violet perfume. The ultra-violet light which activated carotene into vitamin A is not contained in sunlight. Vitamin A will not be known as a "sunshine vitamin" like anti-rachitic vitamin D, which is produced by the irradiation of foods and the chemical ergosterol. Production of vitamin A on a large scale and its manufacture in foods, such as bread and cereals, in the same way that vitamin D is introduced, can be expected to result if the British experiments are confirmed.

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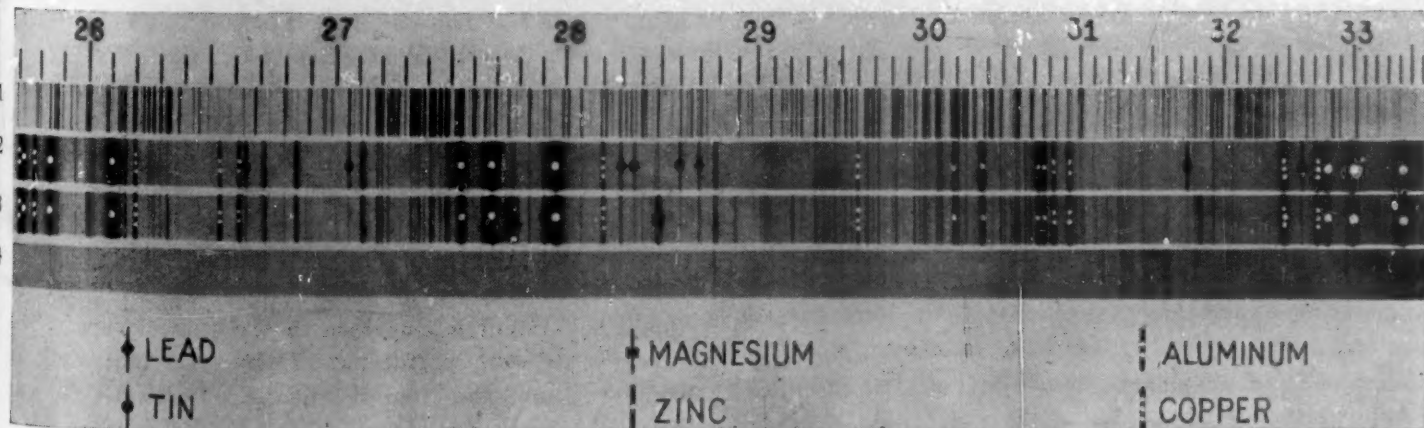
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SCIENCE NEWS

Science Service, Washington, D. C.

THE INTERIOR OF ELECTRONS AND PROTONS

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PROFESSOR ALBERT EINSTEIN has extended his unification of the laws of gravitation and electricity to the interior of the electrons and protons, a realm for which he has been unable heretofore to find a law.

A promising addition to his previous unified field theories of 1929 and 1931 is made in this latest formulation of physical theory by the great German physicist. The details of the new theory are contained in a communication by Professor Einstein and his associate, Dr. W. Mayer, to the Prussian Academy of Science and published in its proceedings under the title: "A Unified Field Theory of Gravitation and Electricity."

There is hope that the permanently accepted consequences of the quantum mechanics will be found in this latest of Einstein's unified field theories. Quantum mechanics deals with the laws of the electrical particles and has been fruitful in the understanding of the realm of the minutely small.

Without a law for the behavior of the electromagnetic field in the interior of the electrons and protons, Professor Einstein had previously found it necessary, as Maxwell had before him, to treat the electrons and protons as foreign bodies embedded in the electromagnetic field, influencing it but not of it. He now assumes a somewhat more general structure of his four-dimensional space-time continuum as expressed in the axiom governing the five component vectors in terms of which he describes this structure. By this means he is now able to set up a series of equations capable of treating the electrons and protons as integral parts of the electromagnetic-gravitational field.

The detailed application of these equations to special problems has not yet been carried out. The complexity of this new unified field theory may be seen from the fact that Professor Einstein requires for its description twenty different functions of the coordinates which in a four-dimensional space requires sixteen independent differential equations for their full description. Actually in the form in which the equations are now written twenty-five differential equations appear. Professor Einstein is, however, able to prove that nine of these can be deduced from the other sixteen, so that the resulting equations are not inconsistent, but, as the mathematicians say, compatible with each other.

In the ordinary electromagnetic equations of Maxwell, there is a system of twelve field equations plus special assumptions governing the behavior of electrons and protons. The ordinary Newtonian equations of gravitation consist of three field equations plus the special assumption that action and reaction are equal. It is not surprising, therefore, that in a unified theory which covers both these systems of equations in their most general form, sixteen equations should be required.

In modern theory of physics, the electron and the pro-

ton have been much in the position of the *deus ex machina* of the old Greek dramas, introduced in the language of the mathematicians as a "singularity" in the field. The nature of the singularity and the laws of the disturbance that it causes in the field is independent of the laws of the field itself, and they are added as a special assumption. It is too early to state whether this new synthesis will banish the *deus ex machina* from physical theories as thoroughly as it has been banished from the modern stage.

The new theory may give a new approach to the understanding of the interior of the electrical corpuscles, the protons and the electrons. As yet it has nothing to do with atomic structure as an atom is a conglomeration of electrons and protons.

In modern conceptions of physics the space between the protons and the electrons in the atomic nucleus is subject to the same laws as the space outside the nucleus. All these laws, both inside and outside the nucleus, are now formulated in terms of quantum mechanics. Professor Einstein has expressed the expectation that all the assured results of the quantum theory would be found in his unified field theory.

PHOTOGRAPHING LIQUID HELIUM

THE first photograph of liquid helium to be taken was shown to members of the Royal Society of Canada, meeting at Ottawa on May 26, by coworkers of Professor J. C. McLennan, of the University of Toronto, who secured it during experiments at temperatures near the absolute zero.

The pictures were taken at just two degrees Centigrade above absolute zero and showed that the surface of this extremely cold liquid helium has a peculiar nature. Professor McLennan and his associates, H. D. Smith and J. O. Wilhelm, discovered hitherto unnoticed changes in the appearance of the liquid helium as it passed from one modification to another at its triple point, the temperature at which solid, liquid and gas can exist side by side.

The depths of the temperature scale, corresponding to below minus 450 degrees on the familiar Fahrenheit scale, were explored in these experiments at the University of Toronto in order to test the Raman effect on liquid helium. This is the discovery for which the Hindu investigator, Professor C. V. Raman, received the 1930 Nobel prize. He found that intense light of a single color is partly changed to other colors when it passes through various transparent substances.

Professor McLennan found that the Raman effect for liquid helium corresponded to the theoretical value. The experiments were performed in the same laboratory in which helium, the noninflammable elemental gas, was first liquefied in America.

THE MYTHICAL PLANET VULCAN

A NEW nail has been driven into the coffin of the mythical planet Vulcan by Dr. H. von Klüber, of the

Astrophysical Observatory at Potsdam. Vulcan was once supposed to revolve around the sun in an orbit within that of Mercury. Such a body would never be seen in the night sky, but would be visible either when it passes in front of the sun, or during a total eclipse, when the bright solar disc is temporarily hidden by the moon, and faint objects in the same part of the sky are made visible. For many years observations to detect it were made at eclipses, without success. It had been quite definitely decided that no such planet exists.

In May, 1929, Professor Erwin Freundlich, director of the Einstein Tower at Potsdam, photographed the eclipse of the sun visible in Sumatra. Though made for other purposes, these plates showed such a profusion of star images that Dr. von Klüber decided to examine them carefully to make sure that Vulcan was not concealed there. For purposes of comparison photographs of the same part of the sky, but without the sun, were made six months later at Potsdam, with the same telescope. If a planet were present, it would betray itself by its motion between the time of the two exposures.

The search proves conclusively that there is no planet as bright as the ninth magnitude, considerably below naked-eye visibility, up to a distance of 40 minutes from the sun. This is approximately equal to one and a third solar diameters. Closer than this the bright solar corona, visible at eclipse time, might have made faint objects invisible, but even there, believes Dr. von Klüber, a planet as bright as the seventh magnitude, also too faint to be seen with the naked eye, would have been found. Thus, he has decided, if there is a planet closer to the sun than Mercury, it is extremely small.

THE VALUE OF WATER

Jobs created by a program of natural resource conservation would come most legitimately under the classification of "income-producing works." This thesis was upheld at the meeting of the American Forestry Association, recently, by its president, George D. Pratt.

"To my mind it qualifies under the operation of the Finance Corporation just as much as does protection of our banking institutions, for in the last analysis these institutions are dependent upon the natural wealth of the communities and states which they serve. I hold that it would be a wise policy for the states to borrow money of the Finance Corporation to protect their natural resources and that it would be a wise policy for the Federal Government to loan money through the Finance Corporation to the states for this purpose."

The speaker held that this project is supported by nine distinct points of advantage. These include: the creation of many jobs; preservation of basic capital; benefits to national credit; promotion of confidence; benefits to agriculture by checking of erosion; stabilization of land ownership; creation of needed recreational areas; furnishing a basis for sound bond issues; conservation of water resources.

Water, its value as a national resource and the means necessary for its conservation and control, made up the dominant note of the discussions at the meeting. The

abuse of this and other natural resources supplied the text for a vigorous criticism of short-sighted industrialists by Samuel S. Wyer, of Columbus, Ohio, consulting engineer.

"America's greatest danger is not from radicals, reds, Socialists or Communists, but from selfish business men who have failed to see the social significance of the forces in our rapidly accelerating machine civilization," he said. "If capitalistic society is to endure, then human rights and the welfare of human beings must be regarded as superior to property rights, and we must recognize that social significance and service, and not mere money-making alone, must guide business practices."

He called for more intelligent appreciation of the flood problem and more concerted effort toward its solution, for cessation of unnecessary stream pollution, and for a lightening of the tax burden on reforested lands as among the steps needed to place water resource conservation on a social rather than a selfish basis.

MENTALLY DEFICIENT CHILDREN

DR. EDGAR A. DOLL, director of research of the Training School, at Vineland, N. J., reported to the meeting of the American Association for the Study of the Feeble-minded that as many as four per cent. of primary school children are mentally deficient, and some careful surveys report as high as eight or even ten per cent. so sub-normal as to require education outside the regular classrooms of the public schools.

Of these, fewer than ten per cent. are cared for in institutions—nine out of ten of the feeble-minded children are at large in the community.

"We know to-day that a person must be something more than feeble-minded to require institutional care," Dr. Doll said. "He must be feeble-minded and helpless, or feeble-minded and dependent, or feeble-minded and anti-social, and so on."

Most feeble-minded children live in their homes in the community and are probably going to public schools, and since very few children are cared for in special classes, about 80 per cent. of the feeble-minded of school age are found in the regular classes. The real problem of education and training of the feeble-minded is, therefore, a community and a public school problem.

A more careful diagnosis and classification of mentally handicapped children than can be made on the basis of intelligence level alone was urged by Dr. Doll as of the utmost importance for educational purposes. Of particular importance he considered a distinction between the high-grade feeble-minded and intellectually retarded normal child. The feeble-minded child is one who will never be able to take care of himself without some degree of supervision. The intellectually retarded or sub-normal child may be intellectually no brighter than the feeble-minded, but he possesses certain other qualities which will enable him at maturity to maintain himself. The feeble-minded are usually handicapped physically and socially as well as mentally; the intellectually re-

tarded are handicapped chiefly in regard to their verbal intelligence.

The distinction is apparently not one of emotional stability alone, but is rather one of common sense and practical judgment in the affairs of every-day life.

LOCATION OF EMOTIONS IN THE BRAIN

NOT only consciousness but also feeling takes place at the base of the left half of the brain in right-handed persons, Dr. Leland B. Alford, of St. Louis, reported to the American Psychiatric Association meeting in Philadelphia on May 31.

Dr. Alford reached this conclusion tentatively after studying patients whose brains had been injured or who had suffered from brain tumors. When the right half of the brain was injured, even if the injury was extensive, the patient appeared conscious and aware of what was going on, and his emotions were normal. Even when the left side of the brain was injured, there was no apparent confusion in the patient's mind, no disturbance of emotions, unless the injury was at the base of the left half of the brain.

It is known that the left half of the brain governs the right side of the body, and the left side of the body is governed by the right half of the brain. In right-handed persons, the left half of the brain is dominant, but when the right half is dominant, the individual is apt to be left-handed.

Dr. Alford studied a series of right-handed patients who were completely paralyzed on one side or the other. It is generally thought that such permanent, complete paralysis of one side of the body results from injury to the base of the brain, rather than to any other part. Of 30 such patients whose paralysis was on the left side, due presumably to injury to the right side of the brain, not one showed confusion of consciousness. On the other hand, of 55 persons suffering from right-sided paralysis, indicating left brain injury, 27, or nearly half, were confused. Dr. Alford hopes to be able to prove his theory more conclusively by finding, in examination after death, actual destruction of or injury to the tissues at the base of the left side of the brain in such patients.

His findings about the emotions also indicated the base of the left brain as their center. He suggests that the behavior disturbances occurring in children who have suffered from encephalitis lethargica, the disease known familiarly as "sleepy sickness" because the patients change day into night and reverse their sleeping habits, are emotional in nature and may be due to a small injury to the brain tissue concerned with the emotions.

ITEMS

A SUN-SPOT so large that it would engulf the earth is now on the face of the sun. It is a single spot with a total diameter of 22,000 miles, of which 9,000 miles is the darker interior portion or umbra. Two earths of the size of ours, 8,000 miles across, could easily be placed within this disturbance in the atmosphere of the sun. Observations made at the U. S. Naval Observatory by C. B. Watts, astronomer in charge of solar studies,

show that the spot is just beyond the center line of the sun and four degrees north of the solar equator. It is roughly circular and is the largest single spot to appear on the sun this year. Keen eyes viewing the sun through heavily smoked glass may be able to detect the spot. A sun-spot minimum is approaching and the sun has been relatively unspotted. Reports from Mount Wilson Observatory, California, showed that two groups of spots containing four spots were observed recently.

KOPFF's comet, a periodic visitor to the earth's part of the solar system, has returned after a six-and-a-half-year absence. It was sighted before sunrise on Wednesday, May 25, by Dr. Bobone, of Cordoba Observatory, Argentina, as reported through the Harvard College Observatory. As seen by Dr. Bobone, it was of the twelfth magnitude, and lacked any tail. It is below the celestial equator, an imaginary line through the sky directly above the earth's equator, and lies a little to the south of the zodiacal constellation Libra, the Scales. Dr. Bobone is a well-known comet finder; it was only a few weeks ago—April 18—that he reported the rediscovery of Houghton's comet. Kopff's comet was discovered for the first time in 1906, by the German astronomer whose name it bears. The last time it visited the neighborhood of the earth, in 1926, it was first sighted by another German astronomer, Professor Max Wolf, at the Heidelberg Observatory.

THE crystal form of insulin, secretion of the islands of Langerhans in the pancreas, which regulates the body's use of sugar, has been studied by means of long-wave x-rays. Professor G. L. Clark, of the department of chemistry of the University of Illinois, has reported his findings on this subject to *The Physical Review*. X-ray photographs of crystals give a picture of the internal arrangement of the atoms in the crystal. Such studies have been made of other crystals. One of the first to be investigated this way was the familiar sodium chloride, our common table salt. With the x-ray investigation and microscopic data, Professor Clark found the crystal form of insulin to be monoclinic, with one angle between 88 and 90 degrees. The individual crystals frequently assume a pseudo hexagonal form. There were 26 molecules per unit cell.

GERMANY'S rescued swallows have come home. Last fall the birds were trapped by the too-sudden advent of winter, before they had made the crucial flight over the Alps into Italy. Bewildered, threatened with exhaustion and starvation, they lingered in southern Bavaria, unable to wing their way over the mountains because of the incessant storms that raged there. Fearing for a serious depletion of the species, bird lovers in Germany and Austria captured thousands of them as they huddled, wet and wretched, on their perches. They slipped identifying bands about their legs, and then shipped them in cages into Italy. Lately the first wave of northward-migrating swallows passed over Bavaria. Some of them were trapped, examined and released. They wore the identifying bands.

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SCIENCE NEWS

*Science Service, Washington, D. C.*THE HEREDITARY ORIGIN OF
OTOSCLEROSIS

TWICE as many women as men are affected with the type of deafness known to physicians as otosclerosis. This and other facts point to an hereditary origin for this physical defect, Dr. Charles B. Davenport, of the department of genetics, Carnegie Institution of Washington, Cold Spring Harbor, Long Island, told a meeting of the Eugenics Research Association recently.

The hereditary mechanism by which this particular type of deafness is handed on from father to son, or more accurately from father to daughter, consists of two defective genes, one of which is in the sex-controlling chromosome. The sex-linked gene, it is thought, acts in some way to upset the body's use of the bone-forming food calcium, while the other works directly to produce the deafness. The disease may also be associated with a disturbance of the pituitary gland, a gland which in youth and middle life exercises considerable control over bony changes.

Otosclerosis is not the ordinary hardness of hearing which comes on in later years and which involves a destruction of the auditory nerve. It is a type of deafness caused by hardening of the membrane around the small chain of bones in the ear, causing the closing up of the oval window leading into the vestibule of the inner ear. It is usually first noticed at adolescence.

Although otosclerosis is thought to affect only about two or three per thousand of the white population of the United States, a much higher proportion is observed among the members of the family of any individual who is affected with it, Dr. Davenport reported. Often from one quarter to one half of such a family group are troubled with hardness of hearing. This strengthens the view that otosclerosis has a genetic basis.

It is believed that when a father is affected with this type of deafness, his daughters have a much greater chance of inheriting the defect than his sons have. On the other hand, if the mother has it, more of the sons will be affected. In other words, it is what geneticists called a sex-linked characteristic. Where both parents are affected an extraordinarily high percentage of the children will be affected, and the marriage of first cousins from a family having a history of this type of deafness is especially apt to give rise to deaf children.

In the effort to get at the origin of the trouble, Dr. Bess Lloyd Milles and Miss Lillian B. Frink, under the auspices of the Committee on Otosclerosis of the American Otological Society and with the cooperation of other physicians, took bodily measurements of more than a hundred families. It was found that the individual with otosclerosis does not differ markedly from his brothers and sisters. The one exception where a considerable difference was found was in the height of the jawbone. This is a dimension which is easily disturbed by hyperactivity of the pituitary gland.

THE COMMON COLD

THE common cold only lasts three or four days. People who tell you they have "had a cold all winter" have really not been suffering from a cold but from some secondary infection, Dr. Wilson G. Smillie, professor of public health administration at Harvard University, told the Conference of State and Provincial Health Authorities of North America meeting in Washington. Dr. Smillie's report covered studies of the common cold in four isolated communities: a "moonshine" village in southern Alabama, Labrador, Spitzbergen, the northernmost inhabited point, and the island of St. John in the Virgin Islands, which was the original of Stevenson's "Treasure Island."

In all these places contact with the outside world was very limited and Dr. Smillie and his associates were able to trace the course of cold epidemics from their very start. Colds are contagious and are spread by direct contact, they found. In Spitzbergen there were no colds from a period in November, soon after the last boat had left, until the day after the first boat arrived the following spring. The miners in this community of 500 persons lived in very hot, humid barracks, went out into extreme cold and wind every morning, worked all day in mines where the temperature was below freezing, and came back to the hot barracks at night. Such conditions would seem ideal for the development of colds, and the fact that none developed disproves the commonly held opinion that exposure to drafts, bad weather and similar environmental factors is a cause of colds. When the first boat arrived in May, the scientists went out to it and examined the people on it before they disembarked. One man was coming down with an acute cold. The same day the mailman from Spitzbergen went to the boat and he caught the first cold in the community. Within thirty-six to forty-eight hours the community was practically incapacitated by a severe outbreak of colds. The same sort of thing was observed in the other communities. In the tropics, however, colds were very mild and without complications such as sinus infections, bronchitis, ear infections and pneumonia. It is these complications which cause the prolonged periods of discomfort and actual illness in the temperate zones and which, except in the case of pneumonia, are generally considered the cold itself.

While colds proper last only three or four days, they seem to pave the way for these secondary infections. Likewise, one cold gives immunity for three months. If you have just recovered from a cold, you can not possibly get another for three months. You can, however, have recurrences of the secondary infections, which may make you think you are having one cold right after another. The average person only gets two real colds a year.

Dr. Smillie and associates in their investigations tried to find in the noses and throats of cold patients the organism causing the cold. They were unable to find,

during the first three or four days, any of the well-known germs. The agent causing colds, however, has been shown by two other groups of workers to be a filterable virus. Vaccines for colds are of course not made from this virus but from the germs of some of the secondary invaders. Consequently they can not prevent the development of a cold, but it is theoretically possible for them to prevent the development of some of the secondary and equally distressing infections.

THE CAUSES OF EPILEPSY

THE parts played by heredity, by glands and by chronic wasting diseases such as cancer, in the development of epilepsy were discussed before the opening meeting in Philadelphia of the American Psychiatric Association.

Epilepsy is not an inherited disorder, according to Dr. Calvert Stein, of the Monson State Hospital at Palmer, Massachusetts. Dr. Stein studied the records and family histories of over 600 epileptics admitted to this institution, and compared the data with similar facts about 190 normal, non-epileptic persons. He found nothing to justify the conclusion that epilepsy is inherited. Fits, convulsions or other seizures, migraine and other nervous or mental disorders did not occur with significantly greater frequency in the families of epileptics than in the families of the normal persons studied.

The acid or alkaline reaction of the body, on which some of the modern methods of treating epilepsy are based, is not as important a factor in the disease as the amount of fluid in the body, studies of Dr. Morgan B. Hodskins and Dr. Riley H. Guthrie, of Monson State Hospital showed. They followed the progress of 55 epileptic patients who developed cancer. In 32 of these patients there was a definite decrease in the frequency of epileptic fits after the onset of the cancer. In the latter disease the body reaction tends to be slightly alkaline, but there is a decrease in the amount of body fluids. In three other diseases in which body fluids are decreased, epilepsy is relatively rare. For these reasons they believe the acidity or alkalinity is of only secondary importance, in that it may indirectly influence the amount of fluid in the body. Their studies also suggested that the effect of oxygen on brain functions may make it an important factor in controlling convulsions.

The relation between epilepsy and certain endocrine glands may be both chemical and psychological, it appears from studies of Dr. Alfred Gordon, of Philadelphia. Convulsions, such as occur in epilepsy, may be brought about by injury or disease of the pituitary gland, but this gland is closely related to other glands of the body, among them the sex glands. This may explain the relationship which he observed between epileptic seizures and certain functions of the sex glands in women on a chemical basis. Dr. Gordon also suggested that the epileptic seizures which he observed in relation to certain physiological processes might represent the patient's retreat or flight from the unpleasant reality of conditions at certain periods of life, such as the "growing pains" of adolescence and the signs forecasting the onset of old age.

PITHECANTHROPUS ERECTUS

THE famous "ape man" of Java, *Pithecanthropus erectus*, whose fossil bones, found forty years ago in the gravel beds of the Solo River at Trinil, are still subjects of scientific debate, was a female and not a man at all. So declares Dr. Aleš Hrdlička, of the Smithsonian Institution, after an exhaustive study of the original specimens, now in Holland, and a trip to the site of the discovery.

The remains consist of a skull cap, a lower jaw, three teeth and a thighbone. The thighbone, which was found fifty feet from the skull fragment, may not have belonged to the same individual; and two of the teeth may also be from a different specimen. But on the assumption that all the bones did belong to the same *Pithecanthropus*, Dr. Hrdlička reconstructs a humanoid creature, female, about 5 feet 5 inches tall, and mature in years.

The skull cap tells the greater part of the tale. That it belonged to a full-grown individual is shown by the solid closing of the sutures or joints, which do not become fully fixed in any animal until the skull is mature. Of the shape and size of the brain cavity, Dr. Hrdlička says:

"The brain form of the *Pithecanthropus*, which because of the filling of the skull cavity with a hard mass did not become observable until very recently, is exceedingly important. Its size, form and gyration remove it at once from the brains of all known apes and bring it correspondingly closer to that of man. It is inconsistent with, and morphologically superior to, its own skull.

"The brain cavity measured in capacity at least 900 cubic centimeters, and this for a female. A corresponding male brain cavity would measure somewhere about 1,150 cubic centimeters. These dimensions connect already with the human. In the Smithsonian collection there are 32 American Indian skulls of small statured but otherwise apparently normal individuals, ranging in capacity from 910 to 1,020 cubic centimeters. In the hugest gorilla the cranial capacity does not exceed, so far as is known, 600 cubic centimeters. In the chimpanzee or orang it never even reaches quite this size.

"The frontal lobes of the *Pithecanthropus* brain, while still low, approach in their form the human. They lack the pointed, keel-shaped appearance they have in all the apes. The rest of the brain was of a higher type than that of the apes. Had this creature advanced in its brain size and form by as much again as it stood above that of the known apes it would be wholly impossible to exclude it from the human category, unless it were done by the establishment of a separate genus of creatures equivalent in brain mass and brain differentiation to man."

But despite this evidence, Dr. Hrdlička insists, it is not legitimate to assert that *Pithecanthropus* was either a form of early man or a type that eventually evolved into man. "The most that appears justifiable, until further and conclusive evidence appears, is to regard the *Pithecanthropus*, as represented by the skull cap, as a high primate of as yet uncertain ancestry and no known progeny, far advanced in what may be termed the

humanoid direction." The height of this female *Pithecanthropus* is based on the length of the thighbone, assuming that it belonged with the skull.

THE MEXICAN EARTHQUAKE

THE earthquake that shook Mexico City on Friday morning of last week had its epicenter, or point of greatest activity, off the Pacific coast of Mexico, at approximately thirteen degrees north latitude and one hundred and five degrees west longitude. The quake began at 5:36 A. M., eastern standard time. These definite data were ascertained by the U. S. Coast and Geodetic Survey, after examining reports from a number of seismological stations collected by *Science Service*.

In Mexico City itself, a *Science Service* correspondent reported, the quake was the most severe felt within a year. It was accompanied by a display of lightning and a dull red glow in the heavens. Town clocks were stopped. Its severity was five on the Mercalli scale, which has ten degrees of earthquake intensity. An intensity of five means a quake strong enough to be felt indoors, but not very much outside, to ring bells and stop clocks, to wake up sleepers, rattle doors and swing suspended objects pretty strongly.

At the U. S. Coast and Geodetic Survey it was stated that the quake seems to have been comparable in severity with the one off the coast of Newfoundland on November 18, 1929, which put most of the trans-Atlantic cables out of commission. The same earthquake caused a slight tidal wave, resulting in a small loss of life on the Newfoundland coast. Whether the present quake will result in any tidal wave action could not be foretold because the direction of the bottom movement, together with other factors in wave causation, was still unknown.

Stations reporting the earthquake were those of the Dominion Meteorological Observatory, Victoria, B. C.; the Seismological Laboratory, Pasadena; University of Michigan; University of California; University of Pittsburgh; University of Wisconsin; Georgetown University, D. C.; Canisius College, Buffalo; Fordham University, New York City; St. Louis University; the U. S. Coast and Geodetic Survey at Tucson, Arizona, and Chicago. The action of the quake, even at a distance, was so severe that it upset the instruments at Pittsburgh and Tucson.

ITEMS

LIGHT of the wrong kind hastens the spoiling of butter and lard, it appears from a report made by Mayne R. Coe and J. A. LeClere, of the U. S. Bureau of Chemistry and Soils at Washington, to the American Association of Cereal Chemists. If oil-bearing foods are kept in a dark place or wrapped with black or the proper kind of green paper they will last much longer. For Mr. Coe and Mr. LeClere have found that darkness and green light between 4,900 and 5,600 Angstrom units delay the development of rancidity much more than normal light. But wave-lengths of light on each side of this narrow green band hasten the production of rancidity more than normal light. Oil-bearing materials in ultra-violet light rapidly spoil.

How far light will penetrate into water, and how far it will go through living tissue, is being studied at the Smithsonian Institution by Dr. F. S. Brackett, as part of his researches into the fundamental physical properties and reactions of living things. Among the facts that his study has developed is the wide difference in penetrating power of two wave-length bands of light that are next-door neighbors in the spectrum. The visible light rays of longest wave-length, at the extreme red end of the spectrum, will pass through nearly a foot of water with a loss of half their energy. Yet radiations in the infra-red, with wave-lengths only a little greater, have a penetrating power in water only about one ten-thousandth as great. In the practical realm, this signifies that most of the radiation from the dull-red lamps frequently used for therapeutic purposes merely warms the surface and does not penetrate into the flesh at all. The radiation that penetrates flesh most effectively lies in a very narrow band of wave-lengths just between the dull-est visible red and the invisible infra-red.

DELAY in operation and promiscuous use of laxatives and purgatives were blamed for appendicitis deaths by two physicians, Dr. Frank K. Boland, of Atlanta, and Dr. John O. Bower, of Philadelphia, who addressed the recent meeting of the American Medical Association. The dangers of delay were brought out by Dr. Boland's investigation which showed that among 219 patients operated on within six hours after the first symptoms, none died; while among 578 operated on after more than 72 hours, 48 died. Dr. Bower explained that laxatives increase the movements of the intestines, thus spreading the inflammation and frequently producing perforation, peritonitis and death. In his study he found that of those patients who took one laxative, one in fourteen died, and of those who took more than one laxative, one in seven died; while of those who had no laxative, only one in eighty died. The moral seems to be, never give a laxative for abdominal pain. If the pain persists for more than six hours it is usually dangerous.

AN intensely hard surface is put on steel tools to increase their usefulness many times by a process of rapid chromium plating reported to members of the Electrochemical Society meeting at Baltimore by Lieutenant A. Willink, of Frankford Arsenal, Philadelphia. As an alloy, chromium made steel stainless, as an electroplate, it gave automobile parts an ever-shiny, non-rusting finish and it hardened tools and parts of machinery subject to great wear. Now, by a method of rapid plating at high temperatures described by Lieutenant Willink, it imparts to tool steel a coat of super-hardness. Lieutenant Willink said that a certain die, plated by the new method, would stand up for 85,000 impressions in the Frankford Arsenal. Protected by an ordinary chromium plate it had a life of about 25,000 impressions and without the chromium protection it was useless after a 4,000 run. The new method has the additional advantage of requiring much less time than the old. Plating is done in a bath at about 150 instead of 65 degrees Fahrenheit and the current density is at least 1,000 amperes per square foot of plating surface.

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SCIENCE NEWS

Science Service, Washington, D. C.

CARBON DIOXIDE IN THE ATMOSPHERE OF VENUS

DISCOVERY that carbon dioxide is probably present in the atmosphere of the planet Venus, next-door neighbor of the earth toward the sun, has been announced by the Carnegie Institution of Washington.

Speculation as to the existence of life on the earth's twin sister planet will be revived by the studies of the infra-red or heat spectrum of Venus made with the world's largest telescope, the 100-inch reflector, at Mount Wilson Observatory, California, by Dr. Walter S. Adams, director, and Dr. Theodore Dunham. The reported discovery is also notable because it is the first time that a gas of any kind has been detected upon any planet except the earth.

For years it has been known that Venus is covered with an atmosphere of considerable extent. Upon the rare occasions of the transit of Venus, when it passes in front of the sun, the planet is surrounded by a ring of light when it is in line with the edge of the sun. This light aura is due to refraction of the sun's rays by the atmosphere of Venus. Clouds cover the surface of Venus so completely that it is believed that astronomers seldom, if ever, see its real surface and the thickness of the atmosphere below the clouds is estimated to be about 4,000 feet.

Drs. Adams and Dunham used a powerful telescope and spectroscope on the infra-red sunlight reflected from Venus and discovered that three bands of invisible heat-light were missing. These were absorption bands that they concluded were due to carbon dioxide in the Venus atmosphere cutting off these particular wave-lengths as the light passed through the planet's atmosphere.

Previous searches for Venus gases, such as oxygen, water vapor and carbon dioxide, all essential to life as we know it on earth, were fruitless.

Carbon dioxide is the gas given off by animal and plant breathing and used by plants in the making of starches and sugars. Its discovery on Venus will justify renewed discussion of the possibility of life of some sort on that planet. Research has shown that the surface temperatures of Venus are somewhat like those of the earth although probably warmer. If future researches should show oxygen and water present, life on Venus might be considered more probable.

The Mount Wilson discovery of carbon dioxide on Venus will undoubtedly encourage those who like to believe that the earth is not the only life-bearing speck of dust in the universe.

THE SUN AS THE ORIGIN OF COSMIC RAYS

BY DR. VICTOR COFMAN

Paris Correspondent of Science Service

EXTREMELY fast electrons, coming from the sun with a speed practically identical with that of light, may be responsible for the production of the cosmic radiation, whose origin is still uncertain. Dr. Alexandre Dauvil-

lier, of the Institut des Hautes Etudes of Paris, puts forward this view in a theory that links together in an attractive manner several happenings of the sky.

"My theory," stated Dr. Dauvillier during a lengthy interview, "gives definite shape to a view which has also been suggested by Lord Rutherford, namely, that very fast electrons accelerated in very weak cosmic electric fields may account for the formation of cosmic rays."

The source of the electrons, according to the new theory, is to be found in the bright spots ("faculae") which are seen on the sun's surface. They represent regions where the temperature reaches seven thousand degrees centigrade. The negatively charged electrons stream out of these hot regions with relatively slow velocity, but are enormously speeded up as they move through the positively charged "atmosphere" of the sun. This atmosphere consists mostly of hydrogen and calcium atoms, positively charged because the ultra-violet radiation from the sun knocks out some of their electrons. The electrical field surrounding the sun thus resembles that around the earth.

The speeded-up electrons coming from the sun are deflected in the form of arcs by the earth's magnetic field as they approach our planet. They strike the upper atmosphere and produce secondary electrons, which are responsible for the luminous effects seen as auroral arcs—first observed by Nordenskjöld in 1878. From the curvature of these arcs one may calculate the velocity and the energy of the original fast electrons, whose course was bent by the earth's magnetism. The velocity is found to be only 30 centimeters per second less than that of light. Hence the electrons need only a few minutes to reach the earth, and arrive practically at the same time as the light itself. This may explain a few remarkable cases of bright flashes on the surface of the sun accompanied immediately by electro-magnetic disturbances upon the earth. The earth is so completely surrounded by traces of these swift electrons, that the cosmic radiation seems to be coming from all parts of the sky.

The energy of the fast moving electrons corresponds very closely to that of the cosmic rays, and Dr. Dauvillier believes that there is no need to look elsewhere for an explanation. He brings in support of his view another set of calculations, based upon the frequency of the auroras seen at different latitudes.

FLOWER SURGERY

DELICATE surgical operations on parts of flowers are used by three investigators at the Station for Experimental Evolution at Cold Spring Harbor, New York, to control the heredity of the plants in their breeding experiments. The experimenters are Dr. J. T. Buchholz and C. C. Doak, of the University of Illinois, and Dr. A. F. Blakeslee, of the Carnegie Institution of Washington.

When pollen grains are deposited in a flower, they adhere to the sticky end of a long, slender projection called the "style" which rises from the seed-bearing part called the ovary. Each grain then sprouts a slender tube that grows downward through the style until it reaches the ovary. This is a real race among the males, and speed of growth determines which shall possess the limited number of females, the egg cells, waiting below and which shall be parents to new plants.

Professor Buchholz and his associates found that some of the pollen-tubes, the hereditary effects of which they especially wished to study, were sluggards in the race and arriving late found no unfertilized females and therefore had no opportunity to leave offspring to bear the particular hereditary qualities which they carried. The differences in growth rate of pollen-tubes defeated the end of the experiment.

Not to be outdone the investigators next conceived the idea of cutting a piece out of the base of the style, decapitating the faster-growing tubes while leaving the slower-growing ones intact. The shortened style was then re-united and the pieces held in place with a splint consisting of a hollow grass straw. Arriving at the cut the slow-growing tubes crossed this barrier and proceeded on in the race without the handicap of having to run against faster competitors.

In practice the method should prove valuable to plant breeders, for its success has been proven by the heredity of plants thus produced. Other scientifically valuable seeds obtained by this method are available for planting during the present growing season.

SELLING GAS BY THE POUND

Do you pay for your domestic gas by the cubic foot, by the pound, or by the "therm"? It depends on the kind of gas you get—old-fashioned or modern. Two new gases, propane and butane, have become cheaply available from gasoline refineries. The new fuels, produced in large quantities, are a godsend to gas companies serving scattered districts. Unfortunately they are a source of worry to the accounting department. The public, accustomed to old-fashioned artificial gas at sixty or eighty cents a thousand feet, doesn't understand that it is fair to pay a much higher price per cubic foot for the new fuel.

Heretofore a gas company has been compelled to build a costly gas manufacturing plant, or a long and expensive pipe line to serve a town far removed from the metropolis. Propane and butane, on the other hand, can be liquefied and shipped economically by rail to a distant small town. One cubic foot of propane will yield as much as three hundred cubic feet of excellent fuel gas upon evaporation. These new gases are extremely rich, running from 2,500 to 3,200 on the heat unit scale in contrast with the 600 units from common city gas. Such fuel is obviously worth two or three dollars per thousand cubic feet of gas.

Unfortunately, the gas company, like the plumber and the tax collector, is a conventional object of public distrust. Hence, if the gas company decides to junk the old town gas plant and sell butane at three dollars a

thousand, long and loud is the wail of protest to the utility commission.

California gas authorities, anxious to escape this unpopularity, in some cases are selling the new rich gas by the pound. The uninitiated do not understand whether the price is high or low, and have to be contented with the realization that the money figures on their bills are the same as ever. One company mixes its high-powered fuel with five volumes of air before delivery. This quantity of air is insufficient to make the gas explosive, but brings its cubic-foot price down to a point which pleases the customer.

Best of all is the new custom of selling gas by the "therm." This new unit of measure, like the kilowatt-hour of the electric utilities, deals neither with meaningless volume nor weight, but with real heat value—the thing we pay for. One therm is enough gas to heat about 600 pounds of water to the boiling point. In certain eastern cities, where future gas prospects are uncertain, a consumer knows exactly what he is getting by paying a fixed price per therm. As the quality of gas rises or falls, the customer gets less or more, respectively, by volume for his money.

PRECAUTIONS AGAINST THE SPREAD OF YELLOW FEVER

TRAVELERS from countries where yellow fever exists, particularly those traveling by air, should have certificates based on blood serum tests showing that they have acquired resistance or immunity to the disease, Dr. B. J. Lloyd, assistant to the director of the Pan-American Sanitary Bureau, told the Conference of State and Provincial Health Authorities of North America, meeting in Washington.

Dr. Lloyd pointed out that yellow fever is still a menace to life and particularly to commerce in the Americas. He quoted a statement of Dr. F. F. Russell, of the International Health Division of the Rockefeller Foundation, to the effect that, because of the very rapid development of air travel, population centers which once had yellow fever but have now been freed of it are again threatened with reinfection with the disease unless persistent, continued effort is made to keep it within bounds.

Recent discoveries of a method of testing for immunity to yellow fever and of vaccinating against it make possible the certificate-method which Dr. Lloyd suggested. By this means it would be possible to tell definitely whether or not a person desiring to leave a yellow fever community would endanger the country to which he was going. If the test showed that he had immunity to the disease, that would mean that he had either had yellow fever or had been vaccinated against it. In either case, he would not introduce it into a yellow-fever-free country by developing it soon after his arrival.

Dr. Lloyd recommended in addition that aerodromes in infectible territory be kept continuously and absolutely free from mosquitoes which carry yellow fever, and that fullest cooperation be maintained between nations, health authorities and transportation companies

in order to prevent reinfection of former yellow fever areas and consequent disruption of air schedules.

THE TREATMENT OF PARESIS BY MALARIA

No appreciable danger of malaria spreading as a result of its use in the treatment of the brain disease, paresis, exists in the opinion of Dr. L. L. Williams, of the U. S. Public Health Service. Dr. Williams explained his reasons for this opinion in a report to the conference in Washington of state and territorial health officers with the U. S. Public Health Service.

Dr. Williams also described the work of his associates in supplying hospitals for the treatment of mental disease with malaria-infected mosquitoes for their work. Most hospitals have only a few cases of paresis a year, and it is hard for them to carry the proper strains of infection along in between cases. So Dr. Bruce Mayne, of the U. S. Public Health Service, working in laboratories of the South Carolina State Hospital for the Insane, breeds the mosquitoes, infects them with malaria germs, keeps them on ice, and when the call arrives from some hospital, ships them by express. He is at present working on the problem of how far he can successfully ship these mosquitoes without their dying or losing their desire to bite upon arrival.

When malaria is used in treating paresis, best results are obtained by letting the paretic patient recover spontaneously from the malarial attack, without giving him quinine for the malaria. This results in the discharge from the hospital of a certain number of malaria carriers, and it is from these carriers that it has been feared malaria might be spread in regions where it no longer occurs.

He does not believe this is at all likely to happen, because the conditions under which we now live are so different from what they were when malaria was prevalent from Canada to the Gulf. Better housing, nearly universal use of screens, draining, and generally improved health and increased resistance of the people all tend to protect them from attacks of malaria. Even those people who do get malaria seldom die of it now-a-days, because their resistance is so much better.

The development of automobile travel during the last ten or twelve years has resulted in great numbers of southern people going north for the summer. Many of them are malaria carriers, yet they have not spread the disease in regions now free of it. Dr. Williams stated that in view of this it was not likely to be spread by the relatively few paretic patients who are malaria carriers.

Some of the alarm over the situation was occasioned, he felt, by the fact that at the same time as the discharge of the first patients treated with malaria, natural conditions in the shape of hurricanes, tornadoes, rains and subsequent drought had upset the living conditions of large sections of the population and also of the mosquitoes in regions recently freed from malaria. A rise in the number of malaria cases followed, and was by some related to the new treatment for paresis. This is unjustified, in Dr. Williams's opinion.

ITEMS

THE earthquake that destroyed part of the city of Eureka, California, on Monday, June 6, was the most severe felt on the Pacific Coast since the Santa Barbara quake of 1925, U. S. Coast and Geodetic Survey investigators told *Science Service*, after examination of data from eleven seismological observatories in the United States and Canada. However, neither Eureka nor any of the other towns that were shaken stood directly over the point of greatest earth movement, for the epicenter was at sea, a short distance off the mouth of the Klamath river. As traced by the Coast and Geodetic Survey, it was in latitude 42 degrees north, longitude 124 degrees west. The time of origin was 3:44 A. M., eastern standard time.

RUINS of a very ancient Indian settlement near Allentown, Arizona, called one of the most remarkable archaeological sites in America, are to be excavated this summer by an expedition from the Bureau of American Ethnology. Dr. Frank H. H. Roberts, of the bureau staff, has left to take charge of the work. Dr. Roberts, who explored the site last season, stated that from three to five seasons of work would be necessary to restore the ancient site to something like its original condition. The settlement is of especial importance scientifically because it was inhabited not only by Pueblos of the Southwest, but also by some of the Basket Makers, who preceded the Pueblos. This gives the village a history which began in a very early century of the Christian era and continued into the Golden Age of the Pueblos, which occurred about 900 to 1200 A. D.

AN insect pest apparently new to this country has been discovered breeding in the stems of greenhouse grapes at Oyster Bay, on Long Island, and is reported by E. P. Felt, director of the Bartlett Tree Research Laboratories in Stamford, Connecticut. The insect belongs to the group known as the ambrosia beetles, and was identified by an expert on beetles at the British Museum of Natural History, London, as a species known only from Korea, Japan and Formosa, where it occurs on several native shrubs. It was probably brought to America, half-way round the world, in some plant introduced from one of those countries.

HEADACHES may be caused by hyper-sensitiveness to certain foods, it appears from a report of Drs. Ray M. Balyeat and Herbert J. Rinkel, of Oklahoma City, to the American Medical Association. These physicians studied the various types of headaches due to this cause. They found that women have longer, less frequent attacks, while men have frequent attacks of shorter duration. The symptoms vary in different persons and in different attacks in the same person. Several members of a family may have them. The only way to determine that the headaches are caused by food sensitiveness is by the trial method; avoidance of the offending food will give relief. This is also the best method of treating, or preventing, the headaches.

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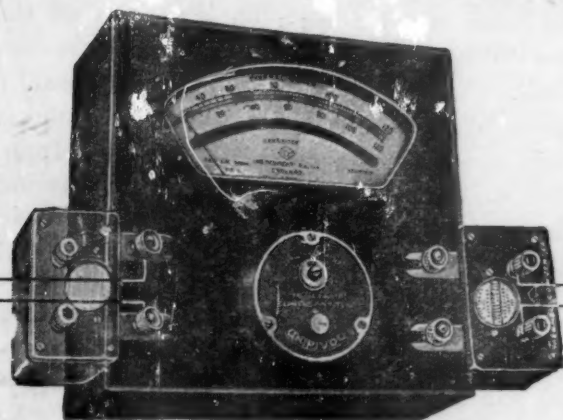
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Science Service, Washington, D. C.

TOTAL SOLAR ECLIPSES

LAST-MINUTE calculations made at the Nautical Almanac Office of the U. S. Naval Observatory by Dr. James Robertson, director of the Almanac, show that the total eclipse of the sun on August 31 will be visible slightly to the west of the path in New England previously forecast for it. The earlier prediction was made in 1929 and published at that time. However, the motions of the moon, which cause an eclipse when that body comes in front of the sun, can not be predicted with absolute precision. For that reason, Dr. Robertson has made use of the latest observations of the moon's position to recompute the circumstances of the eclipse. The latest of these were made on April 20, so that the moon will only have a little over four months in which to wander.

The newly computed path is about seven tenths of a mile farther west than the previous one, but as it is about a hundred miles wide, any one who has selected a point near the center, from which to observe the eclipse, will still be practically as well located. In southern Maine and eastern New Hampshire, where the total phase will last one minute and thirty-eight seconds, on the center line, the duration ten miles away will be only two seconds less, and even forty miles away it will still be more than a minute.

Many scientific parties have selected the vicinity of Conway, New Hampshire, and Fryeburg, Maine, for their observing stations. According to the new calculations, the center line passes just half way between these two towns, which are seven and a half miles apart. North Conway and Center Conway are almost exactly on the line.

After this eclipse Americans must wait 31 years before another suitable shadow of the moon cuts off the sun's light. A total solar eclipse visible from the United States will occur July 20, 1963.

Relying on preliminary charts made by the German astronomer, Oppolzer, some fifty years ago, astronomers have hitherto believed that the next U. S. total solar eclipse would not occur until 1970, but Professor Robertson, by using more refined computations, has shown that this is not the case. In addition to the 1963 eclipse, there will be total solar eclipses visible from this country on March 7, 1970, and on February 26, 1979.

By a coincidence the 1963 eclipse will have its band of totality sweeping across nearly the same area as the eclipse of August 31 of this year. Its path will be about one hundred miles wide and will pass over northeastern Vermont, northern New Hampshire and southwestern Maine. It will include Montreal, Canada, and Augusta and Portland, Maine. Its maximum duration will be about 1 minute 40 seconds.

The 1970 eclipse will last about 3 minutes and pass over the middle of the Florida peninsula near noon when the sun is overhead. The eclipse of 1979 will last about 2½ minutes in its total phase and will have its path of darkness extending south of the Canadian border for nearly a thousand miles from the Pacific coast eastward.

The eclipses of 1963, 1970 and 1979 will be observable near the center of their paths in the United States, the most favorable position for astronomers. Other total eclipses of the sun, on July 9, 1945, and June 30, 1954, will begin in the northwestern part of the United States but will pass into Canada within a few minutes. It is not expected that these eclipses will be of great astronomical interest.

Astronomers who travel long distances to observe the atmosphere of the sun which is visible as its corona only during fleeting moments of eclipse will need to wait only until February 14, 1934, when a total solar eclipse will be visible from a small island in the Pacific Ocean. Other eclipses will occur on June 19, 1936, visible from Japan, and on June 8, 1937, visible from in the Pacific.

THE SPEED OF ROTATION OF THE SUN

FOR many years astronomers have known that the sun varies in light over an eleven-year period, as the sunspots wax and wane. The suggestion that it also varies in the speed of its rotation, but in a period of about thirty years, has been made in a report to the Royal Astronomical Society by John Evershed, following researches made in his private observatory in Surrey.

The sun's rotation speed varies in different latitudes. At its equator it turns most rapidly, rotating once in about 24.65 days, but towards the Poles, the solar surface lags behind. At latitude 35 degrees, the rotation is once in 26.63 days. Dr. Evershed's study is concerned with the sun's equator, where the speed of the surface is about a mile and a quarter, or two kilometers, a second. His observations were made by photographing the edge of the sun with the spectroscope. By measuring the shift of the dark lines which appear in such photographs, the motion towards or away from the earth can be determined.

The mean value of eleven such measures, as made over a period from July to December, 1931, is 2.015 kilometers per second, a value which may be in error as much as .026 kilometers. Previous determinations by other astronomers with similar means have given different values. Those made before 1911 gave values over two kilometers per second, while those made after 1915 gave between 1.90 and 1.94 kilometers per second. A series made by Dr. Charles E. St. John, of the Mount Wilson Observatory, beginning in 1914, showed close agreement, with a minimum of 1.90, until 1929, when there was a tendency for the value to increase, 1.95 being obtained. Dr. Evershed's new results, with a value in excess of two kilometers a second, a return to the measures made between 1900 and 1911, indicate that the change in speed actually occurs.

A NEW VACCINE FOR TYPHUS FEVER

A NEW vaccine which promises to give protection against the endemic typhus fever of the United States has been developed at the U. S. National Institute of Health by Drs. R. E. Dyer, W. G. Workman, A. Rum-

reich and L. F. Badger. The vaccine, made in the same way as was that for Rocky Mountain spotted fever, has been successfully used to protect guinea-pigs against typhus, and when further perfected it will be used on human beings. The first persons to be given it probably will be the group of men who have developed it, thus following the usual custom of scientific men of trying their new products on themselves first.

The vaccine was made from typhus fever-infected rat fleas. The fleas were mashed up in a salt solution. Carbolic acid was then added to the emulsion and the whole mixture allowed to stand for five days. This weakened the typhus germs so that they were no longer capable of causing typhus fever to develop, yet were able to stimulate the body's specific powers of resistance to the disease. About half of the guinea-pigs receiving the vaccine developed resistance, or immunity as the scientists call it, to typhus fever within two or three months. By using a stronger virus from which to make the vaccine, Dr. Dyer and associates hope to give a higher degree of protection against the disease.

Typhus fever in the United States is much milder than the disease as it occurs in European countries. There it is highly fatal and occurs where crowding or poverty or other factors produce unsanitary conditions. It frequently follows wars and was very prevalent after the last war. In this country it is not fatal, although it is an illness lasting from two to three weeks. It was once thought to be the same as typhoid fever, but in the middle of the nineteenth century the two diseases were distinguished.

Typhus fever is caused by a virus which is transmitted in the United States by the rat flea. In Europe it is caused by a slightly different strain of virus and is transmitted by the body louse. Forms of typhus very similar to the American have been reported from Australia, South America, Mexico and the Dutch East Indies. Dr. Dyer hopes to get strains of the virus causing the disease in these countries to determine whether it is the same as the American.

DIAMONDS AND ELECTRICITY

INVESTIGATIONS are being made of the behavior of certain rare types of diamond, which are transparent not only to ordinary light but also to ultra-violet down to a wave-length of 2,300 Angstrom units, and to infra-red heat rays of 8,000 Angstrom units (an Angstrom unit is about four billionths of an inch). These diamonds, of which only very few are known, give an electric current when illuminated by certain kinds of light.

Sir Robert Robertson, chief chemist to the British Government, reports that out of some 250 diamonds that he has tested only five have shown the power to generate an electric current. He believes that he can now recognize such diamonds in a simpler manner from their behavior in polarized light.

Sir Robert showed a photosensitive diamond recently before the Royal Society of London. The precious stone was clamped between two carbons. Brass or lead can also be used to make electrical contact. When illumi-

nated by ultra-violet or by extreme red light it gave an electric current that produced a deflection in a galvanometer, so long as the light shone on the diamond. This photoelectric effect is different from that which occurs in the "electric eye" instruments, where electrons are dislodged and thrown out into vacuum by the impact of light rays or quanta upon certain sensitive metals.

A curious fact in the light sensitivity of the transparent diamonds is that the electric current produced by the ultra-violet rays of wave-length 2,300 Angstrom units can be quenched by light of wave-length 3,650 Angstrom units and thereafter the diamond is no longer affected by the rays of the extreme red spectrum, though retaining its sensitivity to the ultra-violet variety.

EMPLOYMENT OF JOBLESS IN NATIONAL FORESTS ADVOCATED

WHILE citizens in western states are fighting forest fires, insects and diseases and doing other conservation work without pay, the American Forestry Association is fighting for inclusion in the Wagner unemployment relief bill amendments which will employ men on such public work for remuneration.

George H. Collingwood, of the American Forestry Association, estimates that the protection-conservation program of the nation has been curtailed for 1932-33 to the extent of several million dollars, as well as an unlimited amount on its purchase plans. He points out that the Biological Survey in its research and predatory animal control work will be working with a greatly reduced budget this year. Likewise the Bureaus of Plant Industry and Engineering in the U. S. Department of Agriculture. National Park and Forest projects have also been put "on ice," despite the low cost of land and labor at this particular time. The work of establishing migratory bird refuges, so that hunting enthusiasts may not find their sport an empty one in years to come, is practically at a stand-still.

For the work of protecting forests belonging to states and private parties, the federal government plans to give \$1,600,000 in 1933; states and private owners are expending about \$4,400,000; and if the Wagner bill will add \$3,500,000, as proposed by the American Forestry Association, to be loaned to states for this purpose, it is believed that a fairly satisfactory program could be undertaken. Most of the money would go for labor, it is estimated; and circulation of this would begin in from ten to sixty days.

The Wagner bill is sure to provide \$5,000,000 to be loaned to states for protection and improvement of forest roads and trails in the National Forests, and efforts are being made to increase this to \$25,000,000.

It is pointed out that while forest conservation work can not come under the head of strictly self-liquidating projects, indirectly its importance to the wealth of states and communities can not be overestimated.

Congress authorized some time ago the purchase of 1,713,610 acres additional lands in northern Minnesota to be a part of the Superior-Quetico National Forest. Only 127,901 acres of this land has been approved for

purchase at an average price of \$1.81, and no additional land will be bought in 1933, because of the government's economy program. Another area in Minnesota, known as the Mesaba Range, was planned to be added to national forest lands, but title to none of its 171,000 acres will be vested in the government this year. The policy of the United States at present is, despite low purchase costs now available on property, to use public funds only for such projects as will employ labor.

ARSENIC FROM THE BOLIDEN MINE

THE Boliden mine in northern Sweden is expected to bring that country to the position of the largest producer of gold in Europe, among the first ten in the world, with an annual output of about 320,000 ounces. To achieve this position, however, the company, in operating the mine, must also produce copper and silver, selling at low prices, and a large amount of arsenic, 55,000 tons of the oxide per annum. The oxide is the form in which the metal is freed during roasting operations. Being intensely poisonous, the fumes can not be allowed to escape into the atmosphere, so the dust is settled by electrostatic precipitation.

The entire world consumption of arsenical poison could be supplied from this mine, so an accumulation is inevitable. The problem of disposing of this by-product surplus after commercial demands had been met proved difficult. At first the white arsenic, as it is called, was mixed with the ingredients for concrete, and the shapes were sunk in deep water in the Gulf of Bosnia, where the smelter is situated. The company soon decided that a continuance of this plan was costly and undesirable, and storage has now been provided for 120,000 tons—a stock that will prove a menace to producers in other countries, for the Boliden arsenic can be sold to the company's advantage at a nominal price.

Arsenic, although useful in medicine, is a cumulative poison when taken accidentally or administered with criminal intent. It is without taste or smell, so may be administered without exciting suspicion or causing noticeable diagnosable symptoms. For this reason, some of the famous poisoners of history have used arsenic. In the English Maybrick case, the victim was dosed for several weeks with small amounts of solution obtained by soaking poison fly papers in water.

White arsenic, the oxide, and various arsenates and arsenites are used mainly for the destruction of animal or vegetable pests, and for the preservation of building materials. The source is usually one of the many complex sulphides, often associated with iron, copper and silver. As an addition to lead, arsenic acts as a hardening agent, making the metal more suitable for shot. Other limited applications for alloying purposes are known. Research may disclose new industrial uses.

ITEMS

THE tracks of the intensely penetrating cosmic rays, recently photographed for the first time, occur in groups of two or three, apparently radiating from one point, more often than can be accounted for by chance, accord-

ing to Dr. Gordon L. Locher of the Rice Institute. His discovery has been reported to the American Physical Society through *Physical Review*. Dr. Locher concludes that these tracks are not actually the paths along which the cosmic rays travel on their way in from the depths of space. The incoming cosmic rays are, he believes, probably photons or wave-light rays which strike an atom to produce two or three speeding electrons simultaneously. The paths of these secondary electrons produce the tracks that can be photographed. If Dr. Locher is right in his interpretation, his experiments will help to settle the much-disputed question as to whether the cosmic rays are moving particles or wave-like rays much shorter than x-rays. Electrically charged particles produced in the air by the cosmic rays are much less numerous per inch along the tracks than had formerly been believed. This fact clears up the difficulty that the number of charged particles produced by the rays could not be reconciled with the ability of the rays to pierce the earth's atmosphere so effectively as they do.

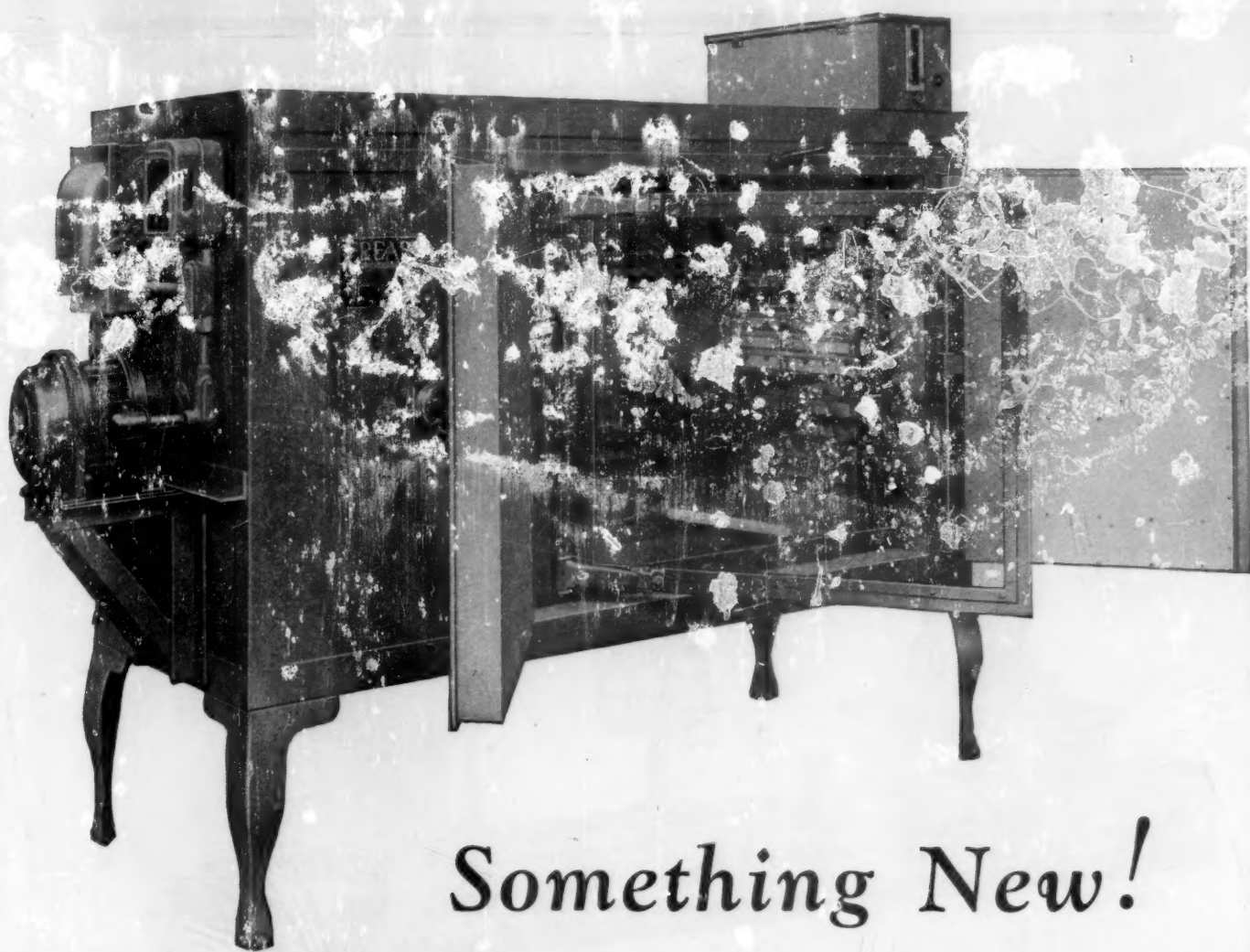
THE eagerly awaited results of the biological work undertaken by Drs. F. P. Bowden and C. P. Snow, of the University of Cambridge, can not give the final proof that the carrot pigment, beta-carotene, has been changed into the growth-promoting vitamin A according to Professor I. M. Heilbron and Dr. R. A. Morton, of the University of Liverpool, writing in *Nature*, because carotene itself is transformed into vitamin A in the living body. Drs. Bowden and Snow believe that they have obtained vitamin A by the action of ultra-violet light on carotene, but, according to Professor Heilbron and Dr. Morton, this could only yield hydrocarbons, that is, substances made up of hydrogen and carbon only. It could not give vitamin A, which contains in addition oxygen in the form of an "alcohol group" (OH). Another test on the power of absorption of light of wavelength 3,280 Ångstrom units, is not considered conclusive evidence, because iso-carotene, a colored substance readily obtained from carotene, has a sharp absorption band in the neighborhood of 3,200 Ångstrom units and similar substances other than vitamin A may be responsible for the absorption observed.

NERVES achieve their effects by means of special hormones which they produce, instead of by direct action on muscles and glands. This is the latest theory of physiologists. Further evidence in support of it was presented by Dr. B. P. Babkin and his associates, Drs. Armine Alley and George W. Stavsky, of McGill University, to the Royal Society of Canada meeting at Ottawa. These investigators found that, under certain conditions, stimulating the nerve of the salivary gland on one side of the mouth produced increased activity and secretion by the salivary gland on the other side. Under the conditions of their experiment, there could be no direct nervous connection between the two glands. This strongly indicates that the nerve itself produces a hormone which acts on the secretory cells of the corresponding gland and reaches the opposite gland by the blood stream.

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